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INTERIM FINAL FEASIBILITY STUDY MAIN REPORT ENVIRONMENTAL ASSESSMENT
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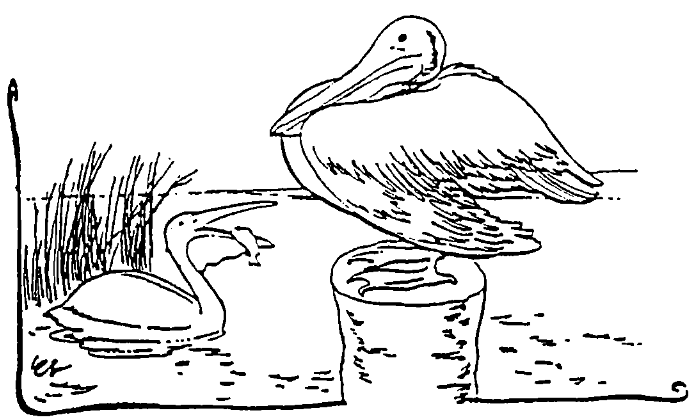
U S ARMY CORPS OF ENGINEERS

Interim Final Feasibility Study and Environmental Assessment Main Report

ELIZABETH RIVER BASIN, VIRGINIA

ENVIRONMENTAL RESTORATION



U.S. Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, VA 23510

June 2001

DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
FORT NORFOLK, 803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096

REPLY TO
ATTENTION OF:

ELIZABETH RIVER BASIN, VIRGINIA

ENVIRONMENTAL RESTORATION

ELIZABETH RIVER BASIN, VIRGINIA
ELIZABETH RIVER ENVIRONMENTAL RESTORATION
FEASIBILITY REPORT

SYLLABUS

The Elizabeth River watershed encompasses approximately 300 square miles within the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia. A tidal tributary to the Chesapeake Bay, the Elizabeth River has become heavily impacted by industrial and urban development over the years resulting in numerous environmental problems and needs. Three hundred years of industrial use have made the Elizabeth River one of the most polluted rivers in the United States. Over the years, stormwater runoff, point source discharges, and spills from commercial, industrial, and military sources have contaminated river sediments and significantly degraded habitat value. Industrial and urban development and related filling activities have destroyed many acres of wetland habitat on the river. Only a fraction of the original wetlands remain to support wildlife and filter storm water runoff, the greatest contemporary source of pollution to the river. It has been estimated that as much as 50 percent of the tidal wetlands in the Elizabeth River basin were lost between 1944 and 1977 (Priest and Hopkins 1997). In 1993, the Chesapeake Bay Program identified the Elizabeth River as one of the three "Regions of Concern" in the Chesapeake Bay where contaminants pose the greatest threat to natural resources.

The Commonwealth of Virginia and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, and a non-profit organization called the Elizabeth River Project have partnered with the Corps to restore the Elizabeth River to the highest level practical. The study area addressed by the feasibility investigation includes the Elizabeth River and its major tributaries including the Lafayette River, Eastern Branch, Southern Branch, and Western Branch. The river basin is located in southeastern Virginia, approximately 150 miles southeast of Washington, D.C. As identified by a 120-member Watershed Action Team, contaminated sediment remediation and wetland restoration have been identified as the two major goals of the restoration project.

The USACE, Norfolk District, in cooperation with the non-Federal sponsors, is pursuing implementation of sediment remedial action and wetlands restoration in the Elizabeth River. Wetland restoration projects are formulated consistent with guidance contained in ER 1165-2-501, Civil Works Ecosystem Restoration Policy, Section 206 of the Water Resources Development Act (WRDA) of 1996, as amended, and EP 1165-2-502, Ecosystem Restoration – Supporting Policy Information. Sediment restoration projects have been evaluated consistent with Section 312 of WRDA1990, Environmental Dredging, as amended by Section 205 of the Water Resources Development Act of 1996; and Section 224 of WDRA 1999; and as promulgated by Corps of Engineers Implementation Guidance dated April 2001, and ER 1165-2-501. The study is in compliance with ER 1105-2-100 (Planning Guidance Notebook), dated April 2000.

In response to the problems, needs, and opportunities for environmental restoration in the Elizabeth River Basin, feasibility level investigations are being conducted under the authority of a resolution dated 14 September 1995 of the House Committee on Transportation and Infrastructure which authorizes investigations "...with special emphasis on the Elizabeth River, Virginia watershed with a view to determining the need for modifications associated with environmental and related purposes." The three year feasibility study represents the next step forward for the project and follows a Federally funded reconnaissance study conducted in Fiscal Year 1997/1998 which determined the need for environmental and other interrelated activities required to restore the Elizabeth River. The 905(b) Analysis (Reconnaissance Report) was approved by Corps Headquarters on 13 November 1997. The Feasibility Cost Sharing Agreement was signed by the Corps and the five non-Federal sponsors - the Commonwealth of Virginia, and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach on 27 July 1998. The results of the feasibility study are presented in this report.

The purpose of a feasibility study is to review water resource problems; develop and evaluate plans to address these problems; demonstrate a Federal and non-Federal interest in proceeding to a pre-construction, engineering, and design phase; and estimate the cost for the project implementation phase. The feasibility study examined the following elements: environmental compliance, engineering feasibility, and cost effectiveness/incremental cost analysis justification. These elements were examined individually to develop a full range of potential solutions. The most feasible solutions were examined collectively to develop a comprehensive restoration plan in the Elizabeth River that will minimize environmental impacts and project costs, and maximize environmental outputs or benefits. The study was conducted in cooperation with the non-Federal sponsors, the Hampton Roads Planning District Commission, and the Elizabeth River Steering Committee workgroup which met monthly.

The recommended plan (National Ecosystem Restoration Plan or NER) for addressing the environmental problems and needs in the Elizabeth River Basin is environmental restoration which involves a combination of both sediment restoration or clean-up at Scuffletown Creek, a tributary to the Southern Branch of the river, and wetland restoration at eight different sites located throughout the river system.

Sediment restoration involves environmental dredging, transport of dredged material by barge or truck, permanent placement in a dredged material placement site; and/or temporary placement, treatment, and permanent placement in a regulated landfill. Sediment restoration will result in improved bottom community abundance and diversity, reduced fish cancers, and reduced bottom sediment contaminants and toxicity.

Wetland restoration involves either removal of fill material to attain intertidal salt marsh elevations, grading, and planting; and/or depositing clean fill material, building an elevation for intertidal salt marsh, grading, and planting. In higher wave energy environments, protective features such as rock sills will be constructed. Wetland construction will result in the creation and/or restoration of approximately 18 acres of wetland habitat, 3 acres of riparian buffer habitat, and 1 acre of tidal creeks. These wetlands and restored adjoining areas will provide needed fish and wildlife habitat, and water quality benefits in a largely urban river setting where natural areas are extremely scarce.

Sediment restoration or clean-up at Scuffletown Creek, a tributary to the Southern Branch of the river would implemented under the authority of Section 312(b) of the Water Resources Development Act (WRDA) 1990, as amended, and wetland restoration at eight sites located throughout the river system would be implemented under the authority of Section 206 of WRDA 1996, as amended. The feasibility report analysis indicates that there is a Federal and non-Federal interest in environmental restoration in the Elizabeth River basin.

The total estimated first cost of the project is $13,190,000, of which the estimated first cost to the United States for sediment clean-up under WRDA Section 312(b) is $5,544,500, and for wetland restoration under WRDA Section 206 is $2,968,000. The first cost to the non-Federal sponsor for sediment clean-up is currently estimated at $2,985,500, and for wetland restoration is currently estimated at $1,692,000.

This is in accordance with Federal regulations, which requires that the NER plan, restoration first costs, be constructed at 65 percent Federal cost and 35 percent non-Federal cost, and the NER plan, recreation first costs, be constructed at 50 percent Federal cost and 50 percent non-Federal cost. This recommendation is subject to the non-Federal sponsors taking ownership of the restored sites, and assuming future operation, maintenance, repair, rehabilitation, and replacement (OMRR&R), including site monitoring, which is estimated at $5,150 annually ($1,150 for wetlands and $4,000 for sediments). The ecosystem restoration benefits exceed the costs of implementation.

This interim final report is the first of several feasibility studies to be conducted over the next ten years. Follow-on feasibility studies will evaluate additional environmental restoration sites in the Elizabeth River Basin.

INTERIM FINAL FEASIBILITY REPORT
ELIZABETH RIVER BASIN, VIRGINIA
ENVIRONMENTAL RESTORATION FEASIBILITY INVESTIGATION

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ACRONYMS FREQUENTLY USED IN DOCUMENT

Acronym	Meaning
B-IBI	Benthic Index of Biotic Integrity
BMP	Best Management Practice
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIDMMA	Craney Island Dredged Material Management Area
COE	US Army Corps of Engineers
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DEQ	Virginia Department of Environmental Quality
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERL	Effects Range Low
ERM	Effects Range Median
ERP	Elizabeth River Project
FONSI	Finding of No Significant Impact
GMS	Groundwater Modeling System
HEP	Habitat Evaluation Procedure
HSI	Habitat Suitability Index
HTRW	Hazardous, Toxic, and Radiological Waste
MSA	Metropolitan Statistical Area
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priority List
ODU	Old Dominion University
PAHs	Polynuclear Aromatic Hydrocarbons
PEL	Probable Effects Level
PGL	Policy Guidance Letter
PPM	Parts per million
PPT	Parts per thousand
PUG	Stabilization Treatment
RCRA	Resources Conservation Recoveries Act
RONA	Record on Non-Applicability
SAV	Submerged Aquatic Vegetation

ACRONYMS FREQUENTLY USED IN DOCUMENT, CONT'D	
Acronym	Meaning
SedRAC	Sediment Restoration Advisory Committee
SQV	Sediment Quotient Value
UDV	Unit day Value
USFWS	US Fish and Wildlife Service
VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
WRDA	Water Resources Development Act

INTERIM FINAL FEASIBILITY REPORT
ELIZABETH RIVER ENVIRONMENTAL RESTORATION
ELIZABETH RIVER BASIN, VIRGINIA

I. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is the Federal Government's largest water resources development and management agency, having begun its Civil Works program to address the nation's water resources needs in 1824. Since that time, the Corps has been involved in improving navigation in rivers and harbors, reducing flood damages, and controlling beach erosion, areas which comprise the Corps' major Civil Works missions. Many projects designed for these missions also generate hydroelectric power: supply water for cities, industries, and agriculture; and provide outdoor recreation. Over the past decade, through the Corps environmental and ecosystem restoration authorities, the Corps has also begun to take on expanded missions in the arena of restoring, protecting, and managing the nation's environment. Ecosystem restoration is now one of the primary missions of the Civil Works program.

BACKGROUND

This report documents an environmental restoration effort being undertaken by the Norfolk District Corps of Engineers (COE) in addressing the problems of the Elizabeth River Basin in Hampton Roads, Virginia. This is a feasibility-level investigation, the meaning of which will be presented later in this feasibility report, which has been printed in two documents: a main report, which provides an overview of the study and several technical appendices, which provide specific details of the study findings and conclusions. The official name of this effort is the "Elizabeth River Basin, Virginia, Environmental Restoration Study."

STUDY AUTHORITY

This study was authorized by a resolution dated September 14, 1995 of the House Committee on Transportation and Infrastructure, which reads in part as follows:

> "Resolved by the Committee on Environmental and Public Works of the United States Senate, that the Secretary of the Army, acting through the Chief of Engineers be, and is hereby, requested to review studies conducted under Norfolk Harbor and Channels, Virginia, published as House Documents 187, 89th Congress and other pertinent reports with specific emphasis on the Elizabeth River, Virginia watershed with a view to determining the need for modifications associated with environmental and related purposes."

STUDY PURPOSE AND SCOPE

The purpose of this study is to formulate alternatives for restoration of the Elizabeth River and to determine the feasibility of implementing those alternatives. The feasibility study document presents, through a plan formulation process, a National Ecosystem Restoration (NER) plan that reasonably maximizes environmental restoration benefits compared to costs, consistent with the Federal objective. The selected plans are shown to be cost-effective and justified to achieve the desired level of output.

The study area encompasses the entire Elizabeth River Basin located in the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, within the southside Hampton Roads area of southeastern Virginia. The project is located in Congressman J. Randy Forbes's 4th Virginia Congressional District and Congressman Edward Schrock 2nd Virginia Congressional District.

The study evaluates the potential for Federal interest in existing watershed problems associated with ecosystem and environmental restoration in the Elizabeth River Basin, Hampton Roads in Virginia. More specifically, these watershed problems fall into two major categories in the Elizabeth River: loss of wetlands and bottom sediment contamination. The study is in compliance with ER 1105-2-100, dated April 2000.

The importance of the Elizabeth River restoration has been recognized both nationally and regionally as depicted in Table 1. While the scope of this investigation focuses on the Elizabeth River, the multi-faceted restoration initiatives that have been evaluated in this document are expected to have much broader ranging ecological benefits to the Chesapeake Bay, its tributaries, and beyond.

This interim final report is the first of several feasibility studies to be conducted over the next ten years. Follow-on feasibility studies will evaluate additional environmental restoration opportunities in the Elizabeth River Basin.

ENVIRONMENTAL ANALYSIS

The environmental assessment analysis evaluated direct, indirect, and cumulative impacts associated only with the two major project alternatives: wetland restoration and sediment clean-up/restoration related to environmental dredging. The NER plan presented in the document will contribute to the environmental restoration of the Elizabeth River. There will be some short-term impacts associated with construction, but these short-term impacts will be outweighed by significant improvements in both bottom sediment quality and wetlands. There will be associated environmental benefits in fish and wildlife resources with the restoration of these habitats.

STUDY SPONSORS, PARTICIPANTS AND COORDINATION

Partners with the Corps in its efforts to restore the Elizabeth River to its highest practical level are the Commonwealth of Virginia, and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach. As sponsors, the Commonwealth and the cities play a key role in the day-to-day activities involved in the development, planning, design, and ultimately, the implementation of any recommended project or projects. The sponsors also share in the financial commitments in terms of the costs of studies and projects. The following photograph was taken at the signing of the feasibility cost sharing agreement in July 1998 in Norfolk, Virginia.

Table 1. ELIZABETH RIVER PRIORITY DESIGNATIONS

Special Designation	Status/Description
Chesapeake Bay Program	**"Region of Concern"** – One of three in the Chesapeake Bay. Chemical contaminants pose a significant threat to the Bay's resources.
Library of Congress Local Legacies Designation	The Local Legacies project seeks to chronicle aspects of our nation's diverse cultural heritage from all 50 states. The resulting documentary materials serve as a record of life in America at the end of the 20^{th} century. With the support of Congressman Norman Sisisky, the Elizabeth River was designated a Local Legacies project on May 23, 2000 in Washington, D.C. Web Site: www.loc.gov
Chesapeake Bay Agreement 2000	**Water Quality Restoration and Protection** Goal: Achieve and maintain the water resources necessary to support the aquatic living resources of the bay and its tributaries and to protect human health. **Sediments** Goal: By 2010, correct all sediment related problems in the Chesapeake Bay and the tidal portion of its tributaries sufficient to remove the bay and the tidal portions of its tributaries from list of impaired waters under Clean Water Act **Priority Urban Waters** Goal: Support the restoration of the Anacostia River, Baltimore Harbor, and Elizabeth River and their watersheds as models for urban river restoration in the Bay basin.
Chesapeake Bay Program Chesapeake Executive Council Toxics 2000 Strategy	**A Chesapeake Bay Watershed Strategy for Chemical Contamination Reduction, Prevention, and Assessment**. Work to do: "...Clean-up contaminants in the sediment in the three Regions of Concern"
Elizabeth River Project	**Watershed Action Plan - "Critical Areas"** Action 1 – Reduce sediment contamination. Action 2 – Increase vegetated buffers, wetlands acreage and forested areas.

The Elizabeth River Project, a non-profit organization, conceived in 1991, by four local citizens, also joins the Corps in this effort. The premise of this group is "This river's large problems will not be solved by government alone, but by a new level of community stewardship." In this regard, the group has undertaken the task of identifying and gaining consensus on the worst problems facing the river and in developing a plan of action to address these problems. Since 1996, the Elizabeth River Project, now over 500 members strong, has been implementing specific restoration projects and initiatives, which address these critical areas.

In order to provide for maximum study input and participation by the study sponsor and other interested organizations and groups, a Steering Committee was established during the reconnaissance phase of this study, the composition of which is presented in Table 2. This committee has continued to meet monthly during the feasibility phase to make decisions about study direction and progress. Two separate technical Subcommittees were formed by the Steering Committee to address the two broad areas of investigation: wetlands restoration and sediment restoration. These Subcommittees meet regularly to make technical decisions about data acquisition and interpretation, study direction and project design proposals. The technical Subcommittees then make recommendations to the Steering Committee for approval.

Table 2. STEERING COMMITTEE AND TECHNICAL SUBCOMMITTEES

STEERING COMMITTEE
Hampton Roads Planning District Commission (HRPDC – Chair) Corps of Engineers (COE) U.S. Fish and Wildlife Service (USFWS) Commonwealth of Virginia* Virginia Department of Environmental Quality (DEQ) Virginia Marine Resources Commission (VMRC) Chesapeake Bay Local Assistance Department (CBLAD) Department of Game and Inland Fisheries (DGIF) Department of Conservation and Recreation (DCR) Virginia Institute of Marine Science (VIMS) Old Dominion University (ODU) City of Chesapeake* City of Norfolk* City of Portsmouth* City of Virginia Beach* Elizabeth River Project (ERP)

SEDIMENT SUBCOMMITTEE	WETLANDS SUBCOMMITTEE
COE USFWS Virginia DEQ VIMS ODU ERP	COE USFWS Virginia DEQ VMRC CBLAD DGIF DCR VIMS City of Chesapeake City of Norfolk City of Portsmouth City of Virginia Beach ERP

*Non-Federal cost sharing sponsors

IMPLEMENTATION PROCESS

The Elizabeth River study is being conducted under the Federal Civil Works process that consists of an established framework by which solutions to the nation's water resources needs and the local communities' interests evolve from ideas to reality. This framework is established by the Water Resources Development Act of 1986, as amended, which provides for a partnership between the Department of the Army, represented by the Corps of Engineers, and the non-Federal interests, represented by the project sponsors.

A Civil Works project passes through four basic phases during its lifetime: planning (reconnaissance and feasibility); preconstruction, engineering, and design; construction (including real estate acquisition and relocation performance); and operation and maintenance. The four phases are shown in Figure 1 and are discussed briefly in the following paragraphs.

Reconnaissance Phase

This phase consists of all activities needed to: (1) define the water resources problems and opportunities of the study area; (2) identify potential solutions to the identified problems and opportunities; (3) determine Federal interest in solving the identified problems and opportunities; and (4) assess the local sponsors' level of interest in and support for the identified potential solutions.

Feasibility Phase

This phase consists of all activities necessary to: (1) develop and fully evaluate alternative plans to address the problems and opportunities of the study area on the basis of economic, environmental, cultural, and other considerations; and (2) recommend specific plans for implementation.

Preconstruction, Engineering, and Design Phase

This phase consists of all activities required to complete all of the detailed, technical investigations and design needed to begin construction of the project. This phase includes the completion of detailed Plans and Specifications.

Construction Phase

This phase consists of all activities required to implement the project that the Corps, the sponsors, and other interested parties have agreed upon.

Operation and Maintenance Phase

This phase consists of all activities required to operate the project and maintain it in a condition that ensures that it will continue to function for the purpose or purposes that it was intended.

Civil Works Project Phases

- ❑ Planning (Reconnaissance and Feasibility)
- ❑ Preconstruction, Engineering, and Design
- ❑ Construction
- ❑ Operation and Maintenance

FIGURE 1. CORPS CIVIL WORKS PROJECT PROCESS

RECONNAISSANCE PHASE RECOMMENDATIONS

The reconnaissance phase of the Elizabeth River study was initiated in April 1997 and ended in July 1998 with completion of a reconnaissance report and signing of the Feasibility Cost Sharing Agreement. The major activities involved in reconnaissance phase investigations were discussed previously. The following are the findings and recommendations of the reconnaissance effort.

Water Resources Problems and Opportunities of the Study Area

Sediment contamination and wetland degradation have been identified as two of the major environmental and ecosystem problems of the Elizabeth River watershed, and have placed tremendous stress on the living resources of the river. This determination was based on work accomplished by a 120-member Watershed Action Team, a representative body of the local business, government, citizen and scientific community. The team was formed in 1995 under the umbrella of the Elizabeth River Project, a grass roots organization conceived in 1991 by four local citizens seeking to solve the river's problems through community stewardship. This team produced a Watershed Action Plan, which obtained consensus in 1996 that the reduction of sediment contamination and the increase in wetlands and vegetated buffers are two of the most critical requirements for ecosystem restoration in the Elizabeth River. There was also consensus that opportunities exist to solve these problems.

Potential Solutions To The Identified Problems And Opportunities

The technology exists to construct tidal wetlands and reduce sediment contamination with a high degree of certainty and reliability. Several specific restoration solutions were identified in the Elizabeth River watershed. Based upon information derived during the reconnaissance study, fifteen potential sediment remediation sites and thirty candidate wetland restoration sites were identified. Toward the end of the reconnaissance study, four sediment sites and nineteen wetland sites were ultimately recommended for further, detailed formulation and evaluation during the feasibility phase. Scuffletown Creek was selected as the one sediment remediation site for detailed evaluation during the feasibility phase, while the remaining three sites were recommended for preliminary evaluation, with subsequent detailed evaluation under separate future feasibility efforts.

Local Sponsors' Level of Interest in and Support for the Identified Potential Solutions

The local project sponsors identified for the feasibility phase study include the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach and the Commonwealth of Virginia. They strongly endorse the feasibility study effort and have cooperatively agreed to pay 50 percent of the cost of conducting the feasibility investigation. On October 5, 2000, at the Elizabeth River Project's Leadership Summit, seven state legislators and 60 area leaders unanimously endorsed plans for cleaning up contaminated sediments and restoring wetlands in the Elizabeth River as proposed in this feasibility study document.

FEASIBILITY STUDY PURPOSE AND OBJECTIVES

The feasibility phase began in July 1998 and ends with the Division Engineer's public notice, scheduled for July 2001 with the completion of an interim final feasibility report. The overall objectives of this feasibility study are to:

- Address two major environmental problems in the Elizabeth River Basin-wetlands loss and degradation, and bottom sediment contamination,
- Develop and evaluate alternative solutions that will improve the environmental quality of the river,
- Determine the feasibility of and Federal Interest in implementing the proposed solutions of wetlands restoration and sediment clean-up/restoration, and
- Ensure that the plans developed are environmentally and socially acceptable, technically feasible, and economical.
- Provide for public input and review of proposed solutions, and
- Assess the Federal and local sponsor support for the continuation of effort leading to the implementation of the recommended projects.

It should be noted at this time that this feasibility study is not the final answer to the clean-up and restoration of the Elizabeth River, but rather an integral part of a long-term, comprehensive effort at the Federal, State, regional, and local levels to make lasting improvements to the river. It is expected that other feasibility studies will follow.

In cooperation with the Steering Committee and the Wetlands and Sediment Subcommittees, the following goals and objectives were developed as presented in Tables 3 and 4.

Table 3. SEDIMENT RESTORATION GOALS AND OBJECTIVES

Elizabeth River Environmental Restoration
Goals/Objectives of Sediment Clean-Up Project
at Scuffletown Creek

FEDERAL GOALS/OBJECTIVES

Section 312 of WRDA 1990, as amended by Section 205 WRDA 1996 and Section 224 of WRDA 1999. Section 312(b) provides dredging authority for contaminated sediment removal and ecosystem restoration provided that projects are evaluated and justified as ecosystem restoration projects under the guidance contained in ER 1165-2-501, Civil Works Ecosystem Restoration Policy. The COE may appropriately consider ecological restoration measures if the measures pertain to traditional water and associated land resources, and measures are associated with restoration of ecological structure and function (COE Implementation Guidance dated 25 April 2001 and ER 1165-2-501).

COMPREHENSIVE PROJECT GOALS/OBJECTIVES

1) Restoration of the Elizabeth River should be accomplished by incrementally remediating contaminated areas such as Scuffletown Creek to levels protective of human health and the environment.

2) Remediation is designed to correct site-specific environmental problems (Scuffletown Creek and vicinity) which may have more far-reaching effects in the river.

3) Sediment remediation goals can be quantitative, qualitative or a combination of both.

a. Potential qualitative benefits may include:
   1. Improved aesthetic appreciation
   2. Improved utility of the area for recreation
   3. Improved community cohesiveness and satisfaction
   4. Improved real estate marketability

b. Potential quantitative benefits may include:
   1. Reduced fish tumors and other deformities
   2. Restored benthic community health
   3. Reduced contaminant levels and toxic impacts in sediment
   4. Reduced potential for transfer of contaminants from the sediment to the water and edible fish and shellfish.

Note: Where comprehensive restoration goals do not meet the Federal Objective, they would be implemented by the non-Federal interests.

Table 4. WETLAND RESTORATION GOALS AND OBJECTIVES

Elizabeth River Environmental Restoration Goals/Objectives of Wetland Restoration
FEDERAL GOALS/OBJECTIVES Ecosystem restoration projects must be evaluated and justified under the guidance contained in ER 1165-2-501, Civil Works Ecosystem Restoration Policy. EP 1165-2-502 dated 30 September 1999 (paragraph 7 c.) states that "...Civil Works ecosystem restoration initiatives attempt to accomplish a return of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions." COMPREHENSIVE PROJECT GOALS/OBJECTIVES Maximize Restoration of Wetland Functional Values & Benefits: Primary Production Fish & Wildlife Water Quality Erosion Buffer Flood Buffer Aesthetics Public Accessibility/Education Value Note: Where comprehensive restoration goals do not meet the Federal Objective, they would be implemented by the non-Federal interests.

II. STUDIES AND REPORTS

The Norfolk District has conducted numerous studies and prepared prior reports related to this study area. A major feasibility study for deep-draft navigation, Deepening and Disposal, on the Norfolk Harbor and Channels, Virginia, was completed in 1981 and served as the authorizing document for a 55-foot channel depth in Norfolk Harbor, as authorized by the Water Resources development Act of 1986. The results of previous investigations are contained in House Document 99-85, in three volumes, entitled "Norfolk Harbor and Channels, Virginia", dated 18 July 1985.

In conducting this restoration study, a number of documents were consulted that had been prepared by others. A partial list is contained in the References section of this report. The most notable of these were the "Historic Losses of Wetland Habitat in the Elizabeth River" produced by the Virginia Institute of Marine Science (Priest, et al.) in 1997; the "Committee Report on Sediment Quality and Sedimentation Processes" and "Elizabeth River Restoration, Watershed Action Plan" prepared by the Elizabeth River Project in 1994 and 1996 (respectively); and the "Technical Assessments in Support of the Elizabeth River Regional Action Plan Development" prepared in 1996 by URS Consultants and administered by the Commonwealth of Virginia, Department of Environmental Quality (DEQ).

EXISTING WATER PROJECTS

Federal projects in the Elizabeth River Basin and adjoining Hampton Roads Harbor are displayed in Figure 2.

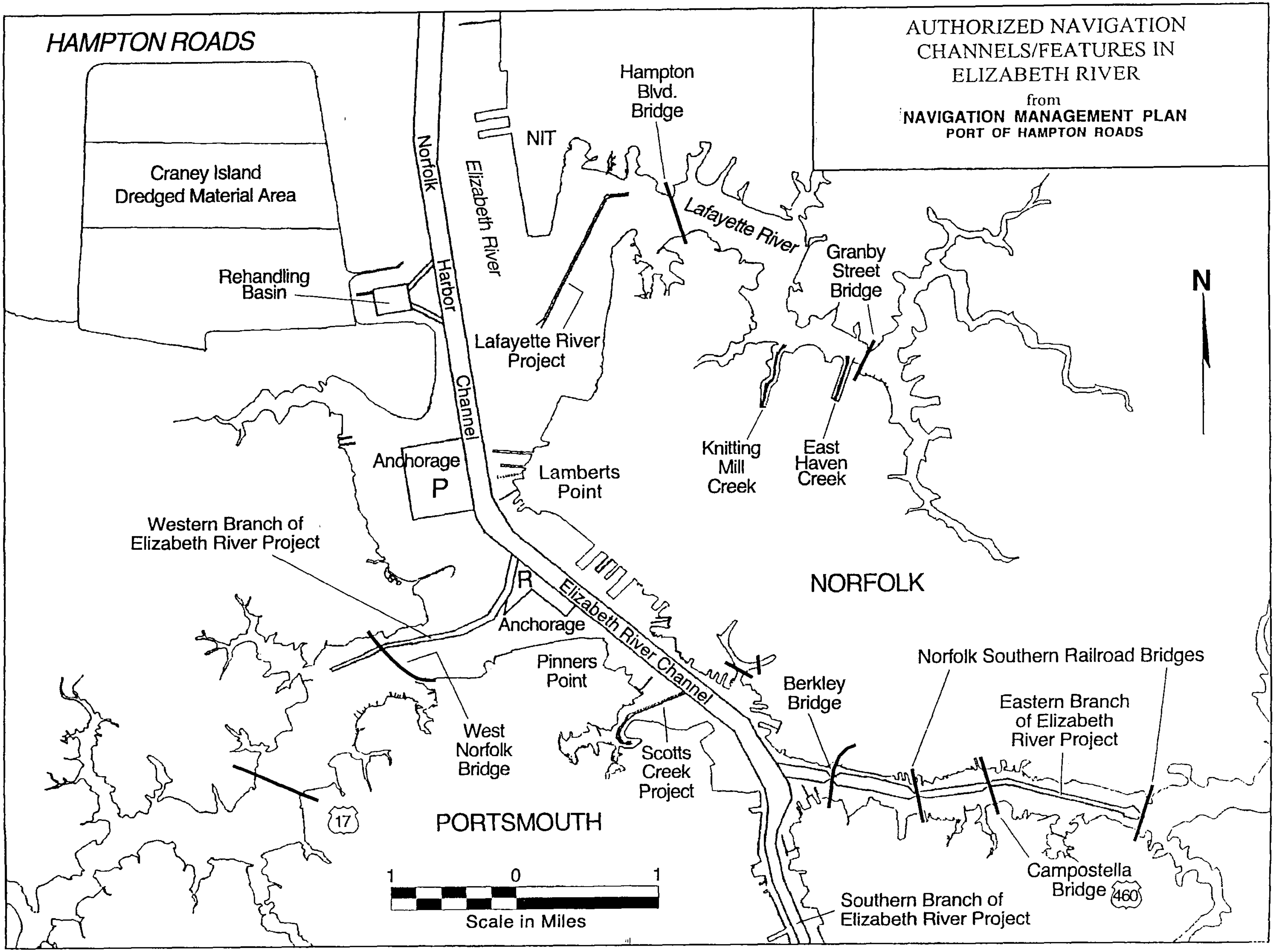

AUTHORIZED NAVIGATION CHANNELS/FEATURES IN ELIZABETH RIVER
from
NAVIGATION MANAGEMENT PLAN
PORT OF HAMPTON ROADS
HAMPTON ROADS
Craney Island Dredged Material Area
Rehandling Basin
Norfolk Harbor Channel
Elizabeth River
NIT
Hampton Blvd. Bridge
Lafayette River
Lafayette River Project
Granby Street Bridge
N
Knitting Mill Creek
East Haven Creek
Anchorage
P
Lamberts Point
Western Branch of Elizabeth River Project
R
Anchorage
Elizabeth River Channel
NORFOLK
Pinners Point
Scotts Creek Project
West Norfolk Bridge
Berkley Bridge
Norfolk Southern Railroad Bridges
Eastern Branch of Elizabeth River Project
Campostella Bridge
460
17
PORTSMOUTH
1
0
1
Scale in Miles
Southern Branch of Elizabeth River Project

FIGURE 2

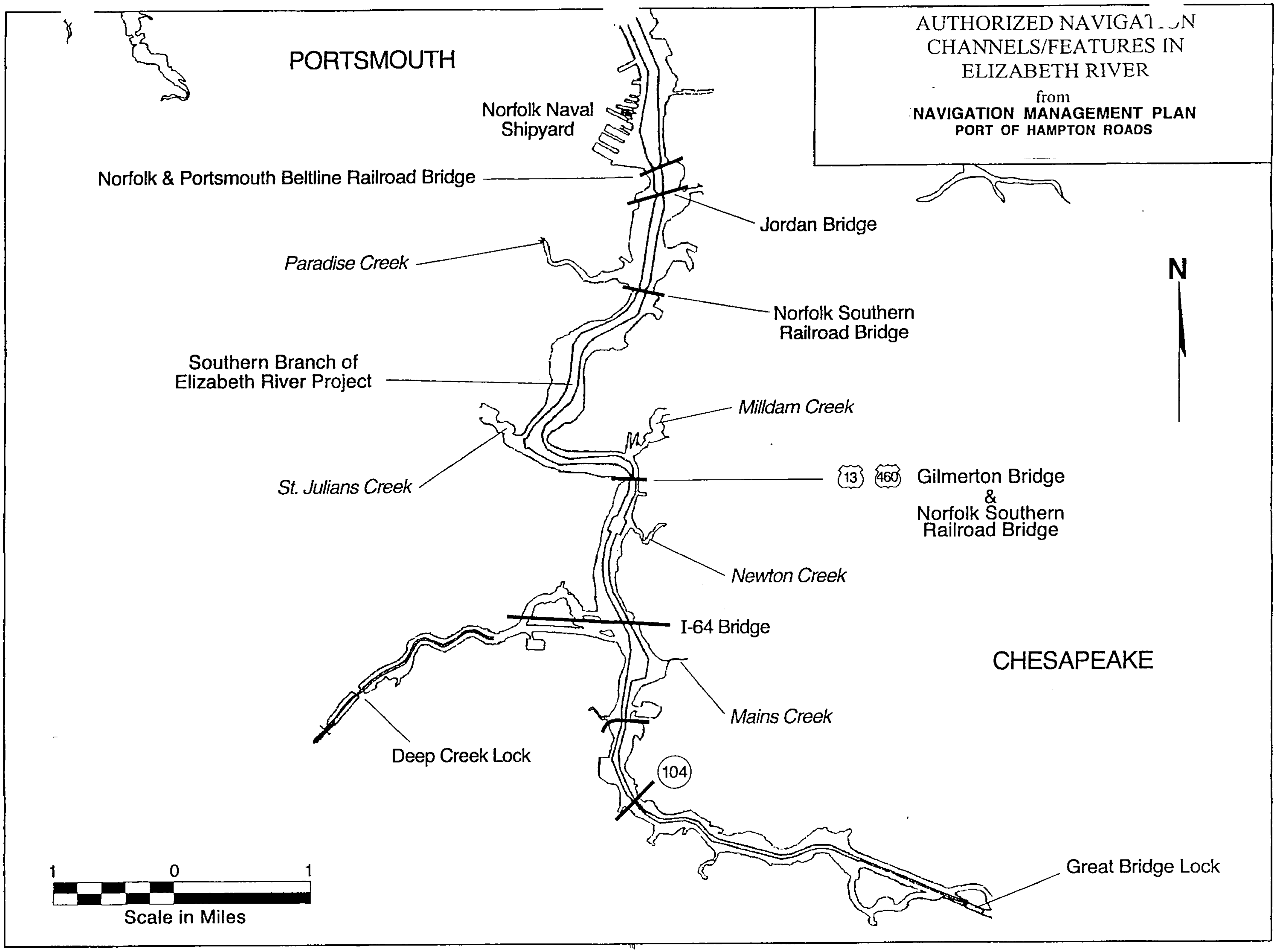


FIGURE 2 (CONT'D)

III. EXISTING CONDITIONS

STUDY AREA

The study area encompasses the entire Elizabeth River Basin located in the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, within the Southside Hampton Roads area of southeastern Virginia as shown in Figure 3. The Elizabeth River is approximately 20 miles in length and has a total drainage area of about 300 square miles (Elizabeth River = approximately 164 square miles; Dismal Swamp = approximately 240 square miles, of which about half drains into Elizabeth River). The river, including its three branches, the Western, Eastern, and Southern, together with the Lafayette River, Nansemond River, James River, and the lower Chesapeake Bay comprise the primary water courses in the Hampton Roads metropolitan area. The photograph in Figure 4 shows the main stem of the Elizabeth River where it divides into the Eastern and Southern branches.

There is an existing deep draft navigation project in the Southern Branch which varies from 35 to 40 feet and is tied to the existing 40-foot, 45-foot and 50-foot outbound channels in Norfolk Harbor along the main stem of the Elizabeth River. Urban, rural, industrial, and residential areas blend together along the Elizabeth River and its branches. More than 13,000 vessels, with a mix ranging from freighters and cargo ships to fishing boats and cabin cruisers use the Elizabeth River annually, many while navigating the Atlantic Intracoastal Waterway.

RESOURCES AND ECONOMY OF THE STUDY AREA

The four cities which make up the study area (Norfolk, Chesapeake, Portsmouth, and Virginia Beach) are part of the Norfolk-Virginia Beach-Newport News Metropolitan Statistical Area (MSA). The MSA includes the same four cities, Suffolk, Isle of Wight County, six localities on the lower peninsula, Gloucester and Mathews Counties on the middle peninsula, and Currituck County in North Carolina.

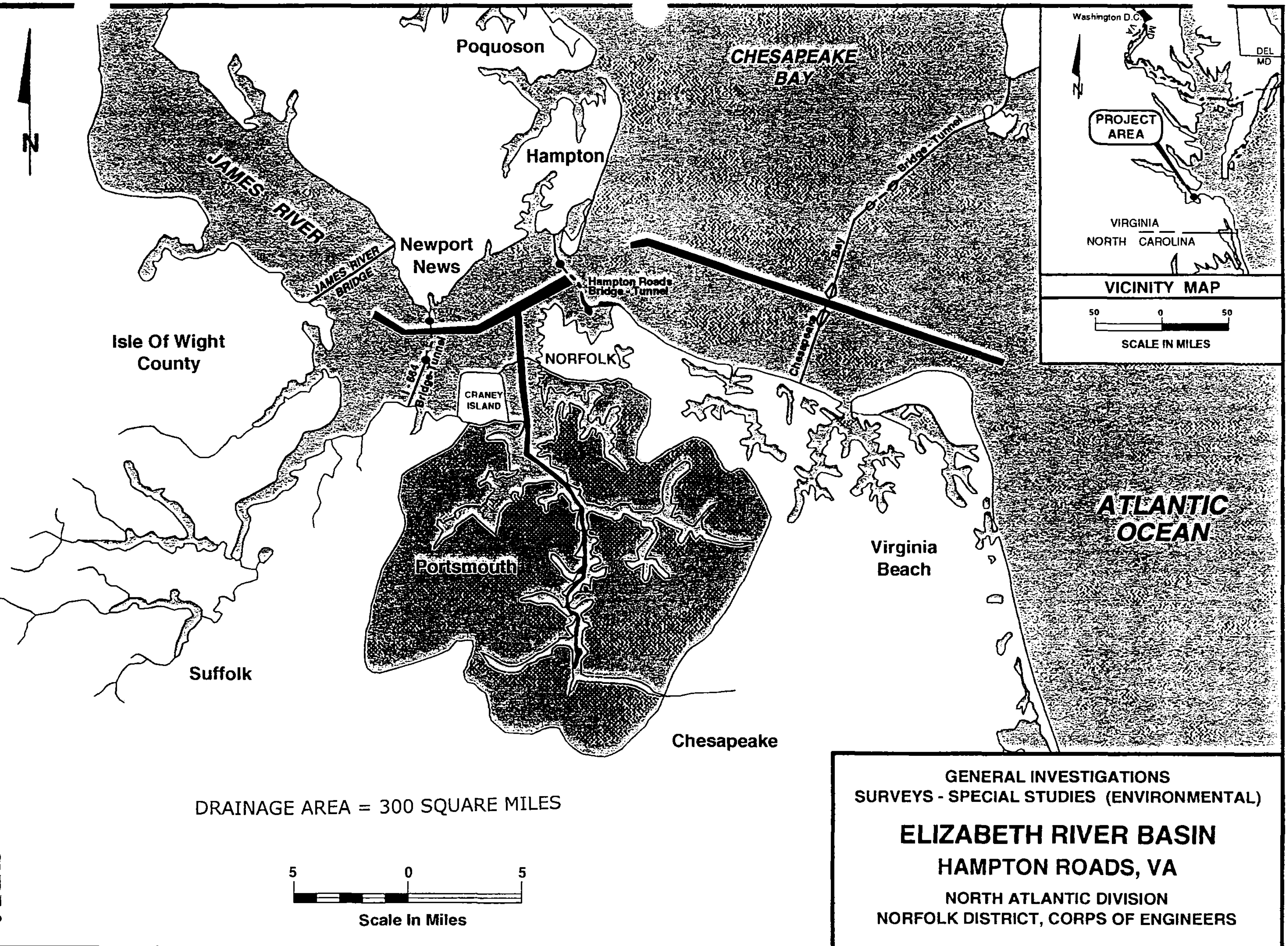

N
Poquoson
CHESAPEAKE BAY
Hampton
JAMES RIVER
Newport News
JAMES RIVER BRIDGE
Hampton Roads Bridge - Tunnel
Isle Of Wight County
I - 664 Bridge-Tunnel
CRANEY ISLAND
NORFOLK
Chesapeake Bay Bridge - Tunnel
ATLANTIC OCEAN
Virginia Beach
Portsmouth
Suffolk
Chesapeake
Washington D.C.
DEL
MD
PROJECT AREA
VIRGINIA
NORTH CAROLINA
VICINITY MAP
50 0 50
SCALE IN MILES
DRAINAGE AREA = 300 SQUARE MILES
5 0 5
Scale In Miles
GENERAL INVESTIGATIONS
SURVEYS - SPECIAL STUDIES (ENVIRONMENTAL)
ELIZABETH RIVER BASIN
HAMPTON ROADS, VA
NORTH ATLANTIC DIVISION
NORFOLK DISTRICT, CORPS OF ENGINEERS

FIGURE 3

FIGURE 4 . SOUTHERN AND EASTERN BRANCHES OF THE ELIZABETH RIVER

SOCIO-ECONOMIC RESOURCES

Population

The Norfolk-Virginia Beach-Newport News Metropolitan Statistical Area MSA (Virginia portion) is one of the more moderately growing metropolitan areas in the state with a 2000 population of 1,478,485. Since 1990, the MSA has had an average annual growth rate of 0.8 percent compared to 1.4 for the state as a whole. All the jurisdictions within the MSA have had increasing populations except Norfolk and Portsmouth, which have been declining since 1970 because of out-migration. In-migration has accounted for most of the increase in the fastest growing localities in the region. Table 5 shows the population history for the metropolitan portion of the MSA.

The four cities in the study area contain over half the population of the MSA. Virginia Beach, with a population of 425,257 (2000), is the largest city in state; Norfolk and Chesapeake are the second and third largest cities in the state. Since 1990, Chesapeake has had an average annual growth rate of 2.7 percent while Virginia Beach's rate for the same period has been 0.8 percent. Both Norfolk and Portsmouth have had negative rates, reflecting declining populations in those cities.

Projections through the year 2050 show growth in all cities and an average annual growth rate of 1.0 for the region. All four cities are projected to have increasing populations although the majority of the growth is expected to occur in Chesapeake and Virginia Beach (Table 5a).

Employment

The Norfolk-Virginia Beach-Newport News MSA is the second largest region of employment in the state, with 22 percent of the total for 1997. Seventy-two percent of the MSA's jobs are located in Norfolk, Virginia Beach, Chesapeake, and Newport News. Job growth rates within the MSA between 1990 and 1997 were highest for Chesapeake by far with a 49.4 percent increase followed by Isle of Wight with a 22.6 percent rise (Bureau of Economic Analysis).

The two largest sectors of employment in the MSA are services and government, which each account for 28 percent of the region's jobs. The services sector is the one which showed the greatest increase between 1990 and 1997, while the government sector experienced the largest decline because of the downsizing of the military. Military employment, dominated by the U.S. Navy, is the largest part of this sector. While the military and Federal civilian employment has declined since 1990, state and local governmental employment has been increasing. The increase in service employment reflects the national trend towards a more service-oriented economy. The largest individual employers in the service industry in the region are the hospitals and their associated medical care facilities.

Other major sources of employment include retail trade, manufacturing, construction, and finance. With the exception of manufacturing, employment in all of these areas has shown growth since 1990. Manufacturing, which provides 8 percent of the area's employment, has had a slight decline since 1990. Much of the manufacturing revolves around shipbuilding and repair, with the largest employer in the state, Newport News Shipbuilding and Drydock, located in the MSA.

Unemployment rates for the region generally are higher than the state average but lower than the national average. The constant turnover in military dependents is a major factor in the rate being higher here than in other urban areas of Virginia. Unemployment also varies significantly within the region with the bedroom communities, such as Chesapeake and Virginia Beach, having the lowest rates.

Table 5. SOUTHSIDE HAMPTON ROADS AND PENINSULA POPULATION DATA

	1970	1980	1990	2000
SOUTHSIDE HAMPTON ROADS				
Chesapeake	89,580	114,486	151,976	199,184
Norfolk	307,951	266,979	261,229	234,403
Portsmouth	110,963	104,577	103,907	100,565
Suffolk	45,024	47,621	52,141	63,677
Virginia Beach	172,106	262,199	393,069	425,257
PENINSULA				
Hampton	120,779	122,617	133,793	146,437
James City County	17,853	22,339	34,859	48,102
Newport News	138,177	144,903	170,045	180,999
Poquoson	5,441	8,726	11,005	11,566
Williamsburg	9,069	10,294	11,530	11,998
York County	27,762	35,463	42,422	56,297
TOTAL	1,044,705	1,140,204	1,365,976	1,478,485

Source: U S. Census

Note: These figures are less than the figures for the MSA since the MSA includes several outlying counties

Table 5a. SOUTHSIDE HAMPTON ROADS AND PENINSULA POPULATION PROJECTIONS

	2010	2018	2030	2040	2050
SOUTHSIDE HAMPTON ROADS					
Chesapeake	220,935*	240,000	271,785	301,465	334,386
Norfolk	239,850*	244,345	251,212	257,081	263,088
Portsmouth	103,551*	106,000	109,789	113,049	116,406
Suffolk	86,294*	110,000	142,993	177,929	221,402
Virginia Beach	500,000	569,000	623,415	672,714	725,914
PENINSULA					
Hampton	150,541*	153,900	159,090	163,548	162,131
James City Co	60,001	67,092	83,895	101,071	121,763
Newport News	190,000	210,981	234,433	255,956	279,455
Poquoson	12,608	14,900	17,308	19,608	22,215
Williamsburg	13,402	14,400	16,264	18,000	19,922
York County	67,004	77,000	94,893	112,941	134,422
TOTAL	1,644,186	1,807,618	2,005,077	2,193,362	2,401,104

*Projections extrapolated from 2000 and 2018 figures; projections for 2030, 2040, and 2050 were based on continuation of trend from 2000 to 2018 with minor modificiations where appropriate.

Sources: Hampton Roads Planning District Commission; Virginia Employment Commission; Chesapeake Planning Department

Income

Income levels for the study area, as measured by per capita income, vary by city but are below state and national levels. Portsmouth had the lowest figure for 1997 with $19,648, Virginia Beach had the highest with $24,425, and Chesapeake and Norfolk had figures in between. The average for the MSA was $21,983, for the state $26,109, and $25,288 for the nation. The region has consistently lagged behind the state and nation in the past 20 years because of the lack of higher paying technical and managerial jobs and large workforce for service jobs.

Land Use

Land use within the study area is a contrast between the highly developed cities of Portsmouth and Norfolk, which contain 33 and 54 square miles of land, respectively, and the larger, much less developed cities of Virginia Beach and Chesapeake, which consist of 248 and 340 square miles, respectively. Land use in Norfolk and Portsmouth is dominated by residential development, large sections of commercial, industrial, and governmental use, with very little vacant land existing in either city.

By contrast, in both Chesapeake and Virginia Beach most of the land in the southern part of the cities is undeveloped. The predominant developed land use is suburban residential, which consists of low to medium density, single-family dwellings located in the northern and central portions of the cities. Higher density multi-family residential land use is located along several of the main arteries in Virginia Beach and in the South Norfolk section of Chesapeake. Commercial development tends to be located along many of the primary arterial highways and at major road intersections. Industrial land use in Virginia Beach is scattered throughout the developed portion of the city while in Chesapeake it is located mainly along the Southern Branch of the Elizabeth River, in the Greenbrier area, along the western portion of Military Highway, and in Cavalier Industrial Park. Most of the agricultural land is located in the southern part of each city. The industrial shoreline status is shown in Figure 5.

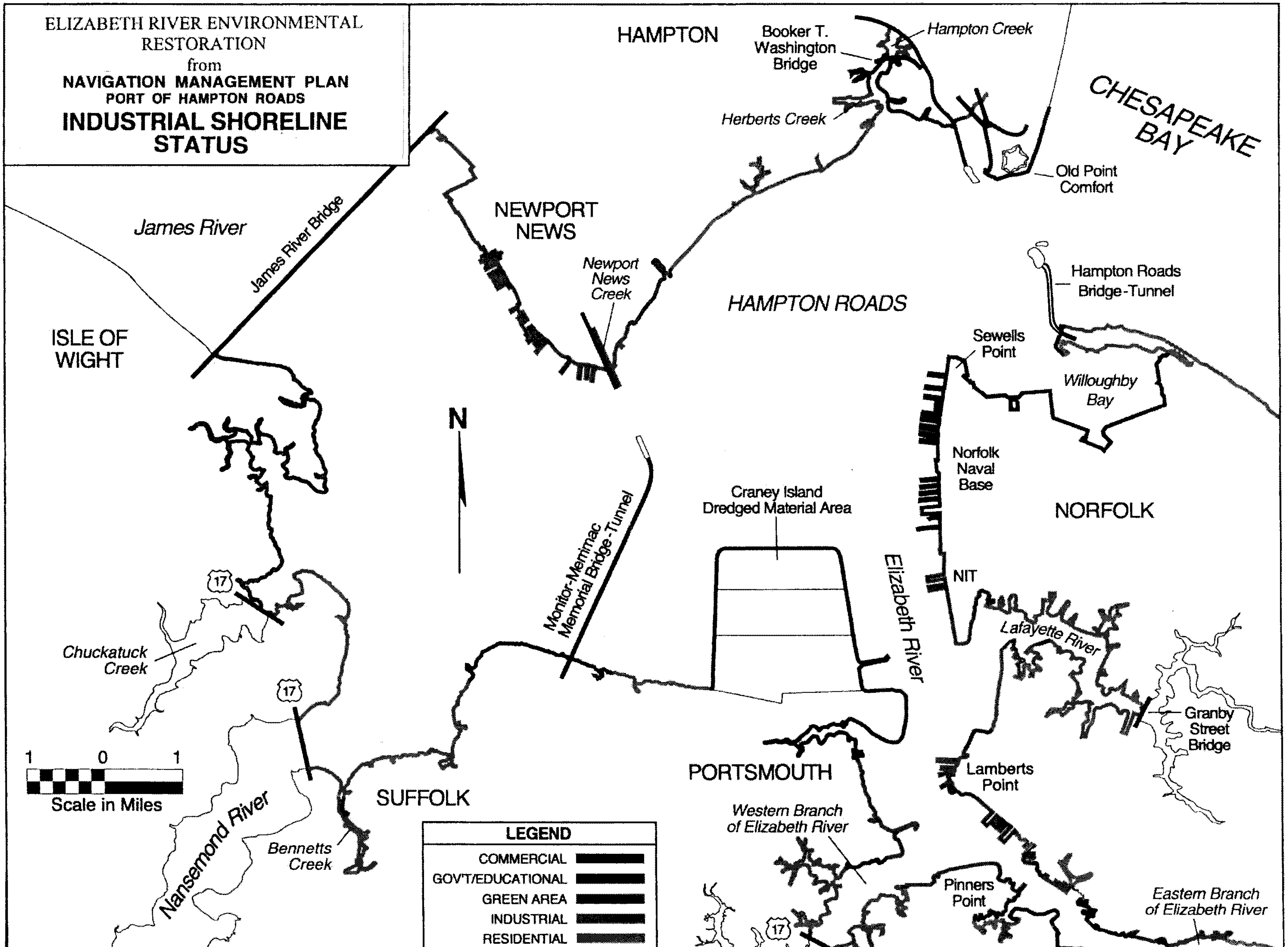

ELIZABETH RIVER ENVIRONMENTAL RESTORATION
from
NAVIGATION MANAGEMENT PLAN
PORT OF HAMPTON ROADS
INDUSTRIAL SHORELINE STATUS
HAMPTON
Booker T. Washington Bridge
Hampton Creek
Herberts Creek
CHESAPEAKE BAY
Old Point Comfort
James River
James River Bridge
NEWPORT NEWS
Newport News Creek
HAMPTON ROADS
Hampton Roads Bridge-Tunnel
ISLE OF WIGHT
Sewells Point
Willoughby Bay
N
Norfolk Naval Base
NORFOLK
Craney Island Dredged Material Area
Monitor-Merrimac Memorial Bridge-Tunnel
Elizabeth River
NIT
17
Chuckatuck Creek
Lafayette River
Granby Street Bridge
17
1 0 1
Scale in Miles
SUFFOLK
PORTSMOUTH
Lamberts Point
Nansemond River
Bennetts Creek
Western Branch of Elizabeth River
LEGEND
COMMERCIAL
GOV'T/EDUCATIONAL
GREEN AREA
INDUSTRIAL
RESIDENTIAL
Pinners Point
17
Eastern Branch of Elizabeth River

FIGURE 5

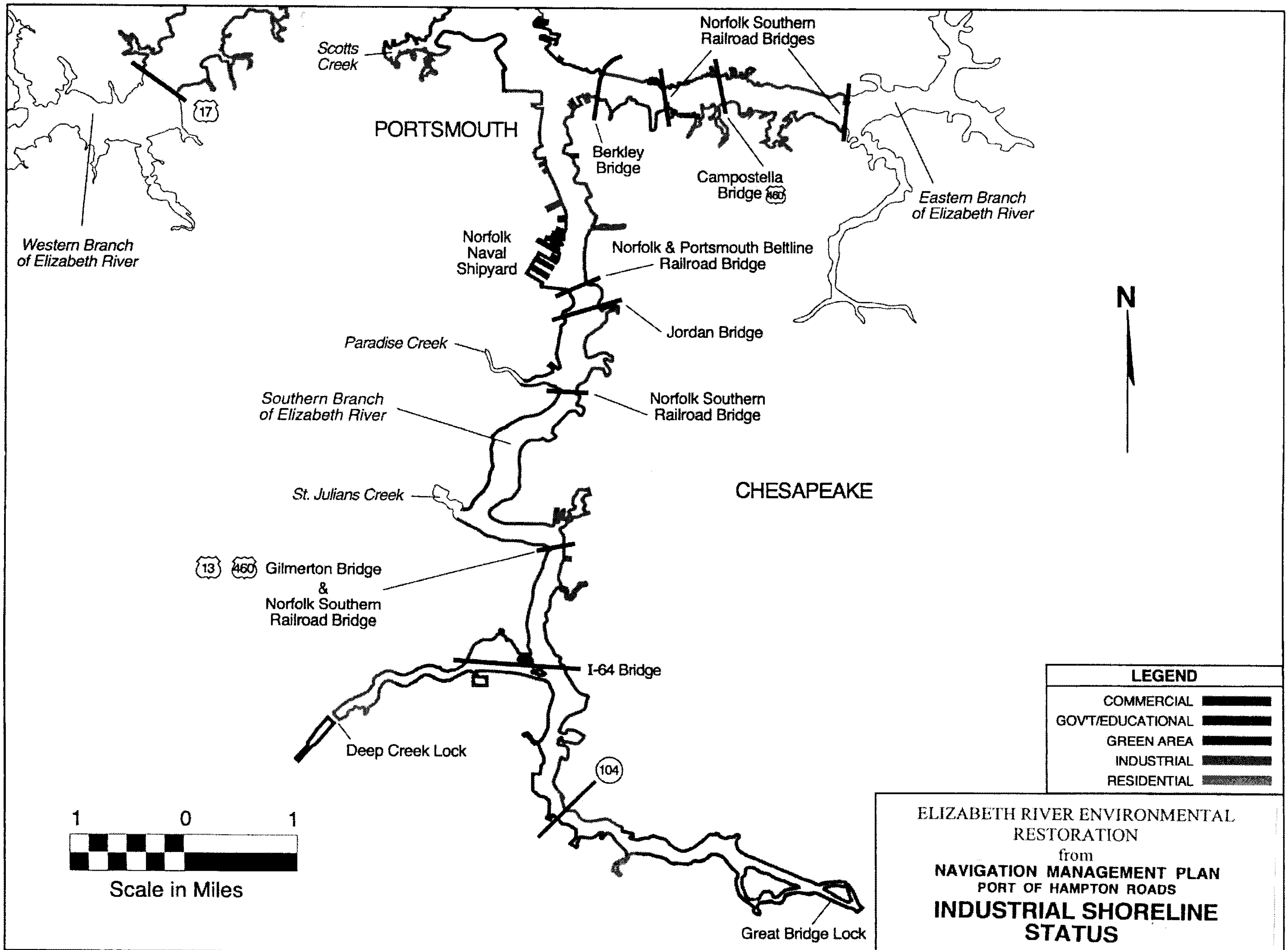


FIGURE 5 (CONT'D)

THE ELIZABETH RIVER ECOSYSTEM

As a tidal, sub-estuary of the Chesapeake Bay, the Elizabeth River provides habitat areas and spawning grounds for fish, habitat for rare terns, peregrine falcons and great egrets, and mud flats for shellfish. Aquatic resources located within the river system include commercially and recreationally valuable finfishes. The Elizabeth River serves as a nursery ground for spot, Atlantic croaker, Atlantic menhaden, weakfish, striped bass, black sea bass, and summer flounder. In addition, the river serves as feeding grounds for adult bluefish, weakfish, spot, and Atlantic croaker. Anadromous fish such as striped bass, American shad, blueback herring, and alewife travel through these areas to reach their freshwater spawning grounds at the head of the Elizabeth River (USFWS, 1989). The most intensive use for spawning is by forage fish, including bay anchovy and Atlantic silverside (Priest, 1981).

Recreational and commercial fisheries are available in the Elizabeth River and the tributaries that empty into the river. Recreational fisheries include estuarine and marine species such as Atlantic croaker, Grey seatrout, striped bass, summer flounder, and bluefish. Major commercial fisheries include blue crab, Atlantic croaker, hard clam, and American eel, and less importantly, striped bass, bluefish, and Grey seatrout. Blue crabs are harvested as both hard-shell and soft-shell crabs for the local seafood market, as well as exported from the Chesapeake Bay area. The hard clam, which has a patchy distribution in the Hampton Roads Harbor area near the Elizabeth River mouth, has been condemned for direct harvesting by the Virginia Shellfish Sanitation Commission but may be used after depuration.

Micro and macro-organisms in the planktonic community are numerous and include diatoms, dinoflagellates, foraminifera, skeleton shrimp, jellyfish, stinging nettles, and larval forms of fish, crustaceans and other organisms.

Many waterfowl species frequent the wetlands and open water of the Elizabeth River during the fall and winter including mallards, buffleheads, American wigeons, American black ducks, lesser and greater scaups, red-breasted mergansers, ring-necked ducks, ruddy ducks, common goldeneyes, green-winged teals, gadwalls, northern shovelers, northern pintails, Canada geese, common and hooded mergansers, and wood ducks. Canada geese, wood ducks, black ducks, and mallards also frequent the area during spring and summer and typically breed here. The diving ducks such as canvasbacks, bufflehead, and scaup frequent the open water areas where they feed primarily upon small invertebrates and aquatic insects. Dabbling or puddle ducks such as the mallard and black duck frequent the wetlands and feed primarily upon seeds and invertebrates. Species found on the river infrequently or in small numbers include tundra swan, mute swan, redhead, surf scoter, oldsquaw, snow goose, and Atlantic brant.

Wetlands are defined by the COE as "...Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." (33 CFR 328.3(b), Regulatory Programs of the Corps of Engineers; Final Rule). Although the Elizabeth River watershed is generally characterized as supporting dense urban and suburban development, wetland systems occasionally occur along the river and in scattered undeveloped areas. Fairly extensive saltmarsh communities dominated by saltmarsh cordgrass *(Spartina alterniflora)* are found near the headwaters and in the more rural portions of the watershed. These wetland systems are generally classified as estuarine, intertidal, emergent, persistent, and irregularly flooded. Wetland systems in the watershed are usually bordered by residential, commercial, or industrial development.

IV. WITHOUT PROJECT CONDITION
PROBLEMS AND NEEDS

Bottom Sediment Contamination

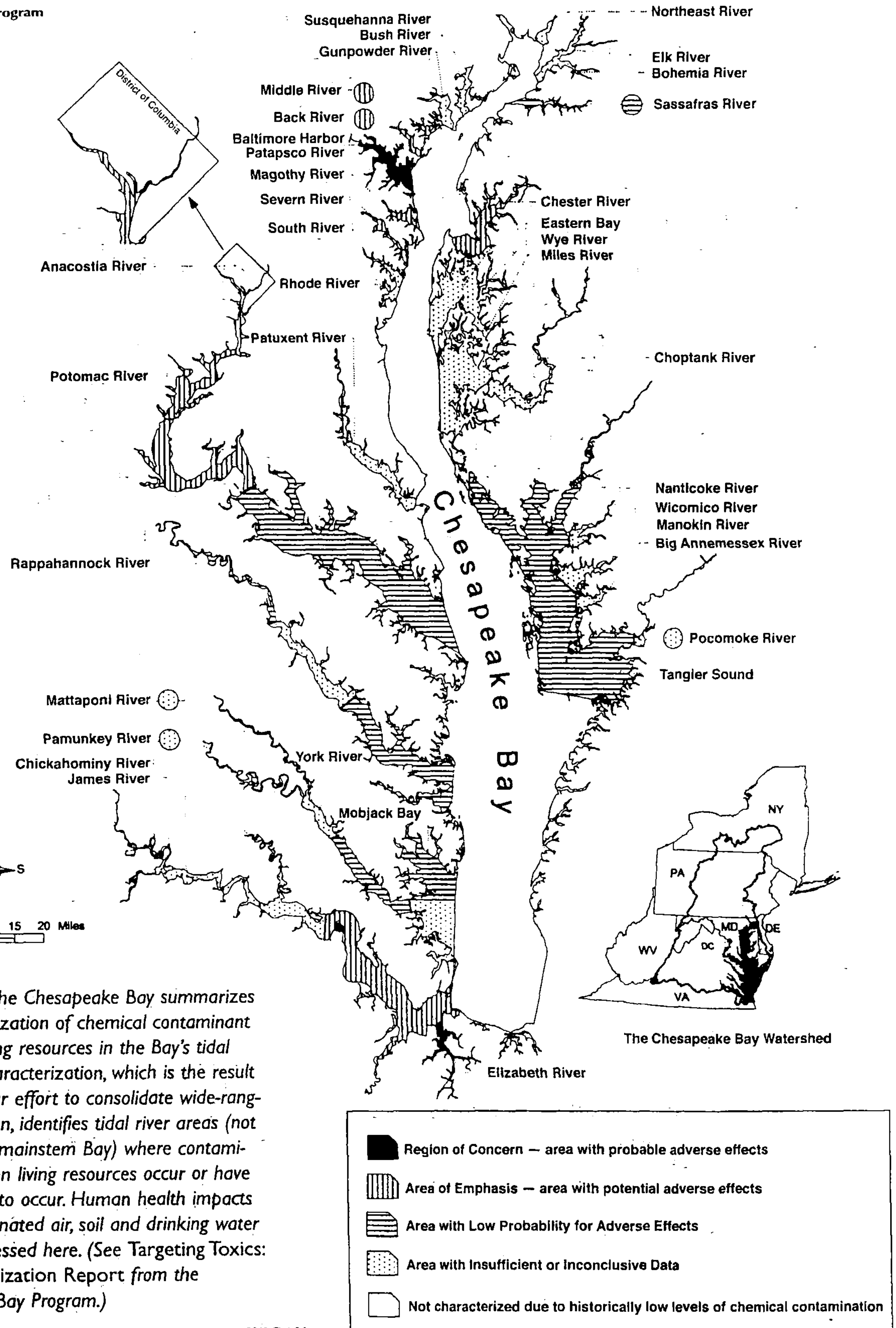
The industrialization and development of the Elizabeth River system over the last 200 years has had a detrimental effect on the ecological health of the estuary and the aquatic organisms that inhabit the river. The creosote plants, shipyards and drydocks, oil terminals and coal-loading operations which lined the river's banks have all combined with urban stormwater runoff to contribute to the contamination of the river. Chemical pollutants, both organic and inorganic, from these sources have collected in the sediments and reached harmful levels. Health problems in fish including fin rot, tumors, cataracts, and other abnormalities have all been linked to high levels of pollutants. The pollutants of primary concern are heavy metals and polynuclear aromatic hydrocarbons (PAHs). The sources of heavy metals include shipyards and stormwater runoff. The primary sources of PAHs include petroleum products, coal, the incomplete combustion of fossil fuels, creosote, and stormwater runoff (Alden, 1995).

Within the Chesapeake Bay watershed, high levels of sediment contamination are found in the Elizabeth River, Baltimore Harbor area, and the Anacostia River. Sediment contamination concentrations in these areas are much higher than those found elsewhere in the Chesapeake Bay. Each of these areas has several contaminants at concentrations above the PELs (Probable Effects Levels), posing a significant risk to aquatic organisms. The Chesapeake Bay Program designated these three areas as "Regions of Concern" (Figure 6), and the District of Columbia, Maryland and Virginia have developed and are implementing action plans to address toxic pollution problems in their watersheds.

Living Resources Impacts. The Elizabeth River is a sub-estuary of the Chesapeake Bay and is heavily contaminated with a variety of pollutants, particularly PAHs. Sediment gradients of PAHs were measured in the following studies: Hargis et al., 1984; Bieri et al., 1986; and, O'Connor and Huggett, 1988. Examination of benthic communities in the Elizabeth River suggests that contaminated sediments have adverse effects. Uptake of organic compounds in fish has been observed by assaying bile from exposed fish. Bioaccumulation of PAHs in commercially fished, resident crabs has also been documented. In addition, the frequency and intensity of neoplasms, cataracts, enzyme induction, fin rot, and other lesions observed in fish populations (mainly *Leiostomus xanthurus*, spot) have been correlated with the extent of sediment contamination (Van Veld et al., 1990). Laboratory studies have been conducted to

Status of Chemical Contaminant Effects on Living Resources in the Chesapeake Bay's Tidal Rivers

Chesapeake Bay Program



This map of the Chesapeake Bay summarizes the characterization of chemical contaminant effects on living resources in the Bay's tidal rivers. The characterization, which is the result of a three-year effort to consolidate wide-ranging information, identifies tidal river areas (not including the mainstem Bay) where contaminant effects on living resources occur or have the potential to occur. Human health impacts from contaminated air, soil and drinking water are not addressed here. (See Targeting Toxics: A Characterization Report *from the Chesapeake Bay Program.)*

FROM: CONTAMINANTS AND THE CHESAPEAKE BAY, CHESAPEAKE BAY PROGRAM FACT SHEET NO 1, "TOWARD A MORE CONTAMINANT-FREE BAY"

FIGURE 6

elucidate whether the sediments were responsible for the observed effects (Van Veld et al., 1990). Fish maintained in the laboratory in contact with sediments taken from the Elizabeth River exhibited several of the symptoms observed among fish populations in the field. Additional laboratory studies have implicated contaminants from sediments as causal agents for other effects, such as immune system dysfunction.

The loss of wetlands along the river's banks has eliminated much of the natural pollutant buffering capacity of the watershed. Additionally, the relatively infrequent and small input of freshwater along with the slight topographic relief result in poor flushing of the system (Alden, 1995). As a result, the river sediments act as a sink for contaminants. These contaminants may then be released to the water and serve as a chronic source of pollution. Currently, dredging removes some of the contaminated sediments, but dredging only has effect on the deepwater channel and channel edges.

Bottom Dwelling Organisms (Benthos). Benthic invertebrates are a large and diverse group of animals that encompass many different habitat niches on the river bottom. These organisms serve as a major link in the estuarine food web, passing energy from primary producers (phytoplankton and plants) and bacteria to top carnivores (fishes and crabs). Many commercially important species utilize the benthos as a food source throughout their life cycle or during juvenile stages. Thus, much of the fisheries harvest from the bay is dependent on the production of invertebrates living in bottom sediments.

The ecological value of the bottom community is complex but includes:

- activities that affect the flux of materials across the sediment-water interface (i.e. burrowing),
- providing a food source and an essential link to higher trophic levels in the estuarine food web, and
- providing constituent species (crabs, oysters, clams) that are commercially and recreationally valuable.

The primary stressors on the bottom community are the presence of a wide variety of toxic substances. Bottom (benthic) communities have been widely used in assessing the health of aquatic systems because species tend to be sedentary, relatively long lived, comprise species with variable stress tolerances, and have important ecological roles.

Among the attributes of healthy benthic communities cited by Dauer (1993) are:

- high species richness (many species per site)
- high biomass (weight of living tissue)
- dominance of long-lived species, and
- many deep-burrowing species (>5 cm in sediment).

Many benthic species are classified as either equilibrium species (long lived, deep burrowing, mostly bivalve mollusk) or opportunistic species (short lived, rapid colonizers, live near sediment surface). Unstressed bottom communities are characterized by a high proportion of equilibrium species, while stressed communities exhibit a high proportion of opportunistic species (Ranasinghe, et al., 1993).

Over the past 25 years, a number of studies of the bottom community in the Elizabeth River, primarily the Southern Branch, have been conducted. All of these studies resulted in similar estimates of the bottom community as being highly stressed. Dauer (1994) performed a trend analysis on benthic community parameters (biomass, abundance, species richness and opportunistic versus equilibrium species) for the period 1989-92. Table 6, drawn from Dauer's (1993) data, provides a comparison of the average values for bottom community attributes in the Southern Branch with a reference site in the York River.

Table 6. COMPARISON OF SIX BENTHIC COMMUNITY ATTRIBUTES FROM THE ELIZABETH RIVER SOUTHERN BRANCH WITH A REFERENCE SITE OF SIMILAR SALINITY IN THE YORK RIVER

Community Attribute	Elizabeth River Southern Branch	York River
Species richness (avg. #/sample)	4-7	10
Biomass (wt./sample)	<1g/m^2	>50g/m^2
Abundance (individuals/sample)	700-2,800	4,000
Biomass deeper than 5cm in sediment	2-15%	60%
Equilibrium species of total biomass	1-15%	80%
Opportunistic species of total biomass	45-75%	5%

The great disparity in biomass and the ratios of opportunistic versus equilibrium species between the Elizabeth River and the York River is striking and all of these measures of community health reflect that the Elizabeth River, and particularly the Southern Branch, as having a highly stressed benthic community.

A study of the macrobenthic communities of the Elizabeth River watershed was conducted in summer 1999 (Dauer, 2000). One of the objectives of this study was to characterize the health of regional areas of the tidal waters of the Elizabeth River as indicated by the structure of the benthic communities. These characterizations were based upon application of benthic restoration goals and the Benthic Index of Biotic Integrity (B-IBI) developed for the Chesapeake Bay to five primary strata: the Mainstem of the Elizabeth River, the Southern Branch, Western Branch, and Eastern Branch, and the Lafayette River. Two additional strata were sampled for benthic community condition: Scuffletown Creek, the proposed location for sediment contaminant remediation and an additional nearby small creek system, the Jones and Gilligan Creek complex.

The condition of the seven strata was compared to the results for all Virginia tidal waters for 1999 based upon the random sampling of 100 sites as part of the on-going Virginia Benthic Monitoring Program. In 1999, Virginia tidal waters averaged 30% degraded benthic bottom. All seven strata for the Elizabeth River were higher than this value: 52% for the Mainstem of the river, 64% for the Eastern Branch, 72% for the Western Branch, 92% for the Southern Branch, and 64% for the Lafayette River. Scuffletown Creek and Jones-Gilligan Creek both averaged 76%, failing the Benthic Restoration Goals (Figures 7 and 8). In general for all Elizabeth River strata, species diversity and biomass were below reference condition levels while abundance values were within reference condition levels. Community composition was unbalanced with levels of pollution indicative species above, and levels of pollution sensitive species below reference conditions. The only exceptions to these patterns were the Mainstem of the river where biomass and levels of pollution sensitive species were within reference condition levels.

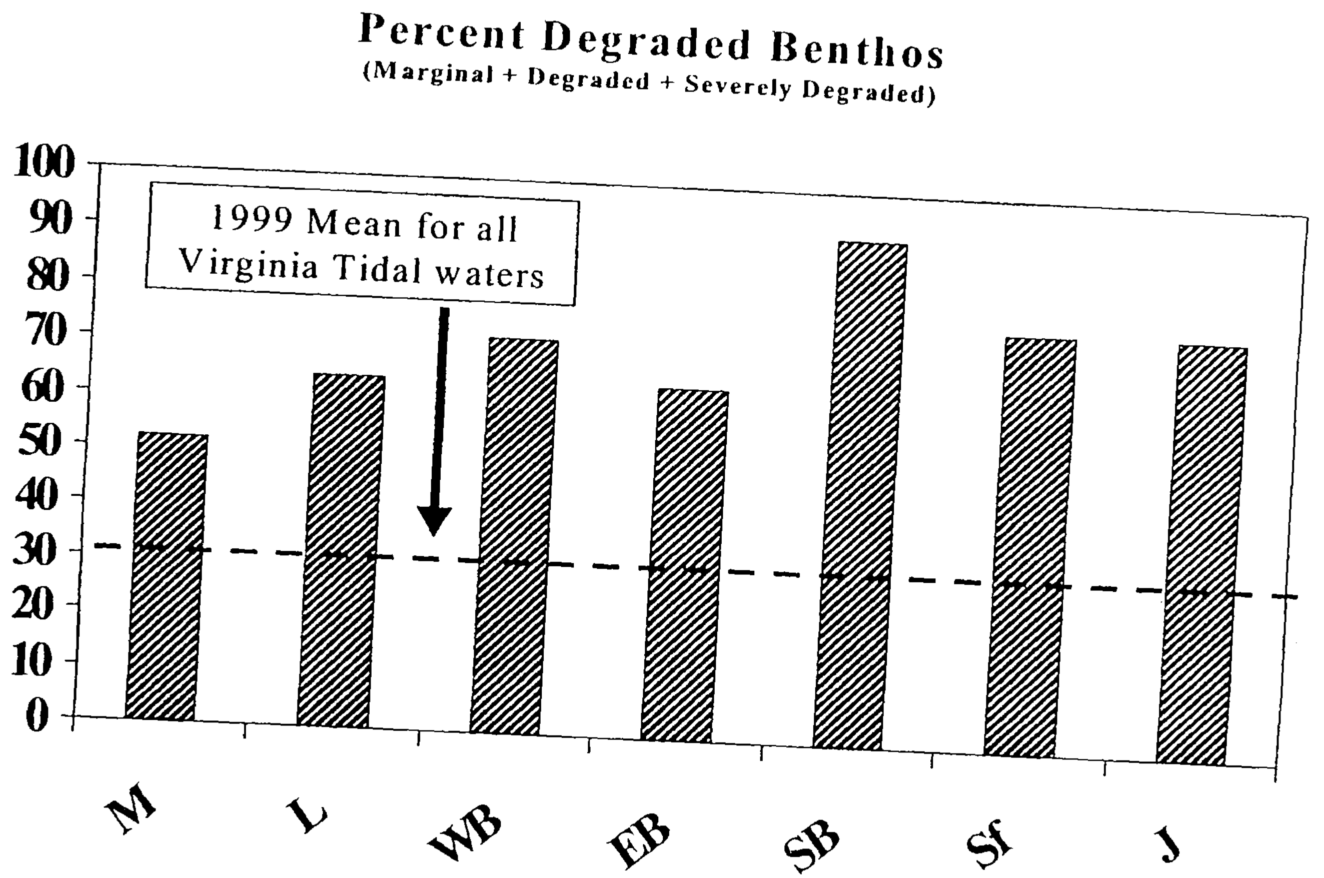


FIGURE 7

Summary of percent area of each stratum failing the Benthic Restoration Goals. Includes marginal, degraded and severely degraded categories as defined in text. Shown are the seven strata of this study and the 1999 average value for all Virginia tidal waters. Abbreviations: Bay - Mainstem of Chesapeake Bay, M - Mainstem of Elizabeth River, L - Lafayette River, WB - Western Branch, EB - Eastern Branch, SB - Southern Branch, Sf - Suffletown Creek, J - Jones-Gilligan Creek. (D. DAUER, 2000)

Percent Degraded Benthos
(Degraded + Severely Degraded)

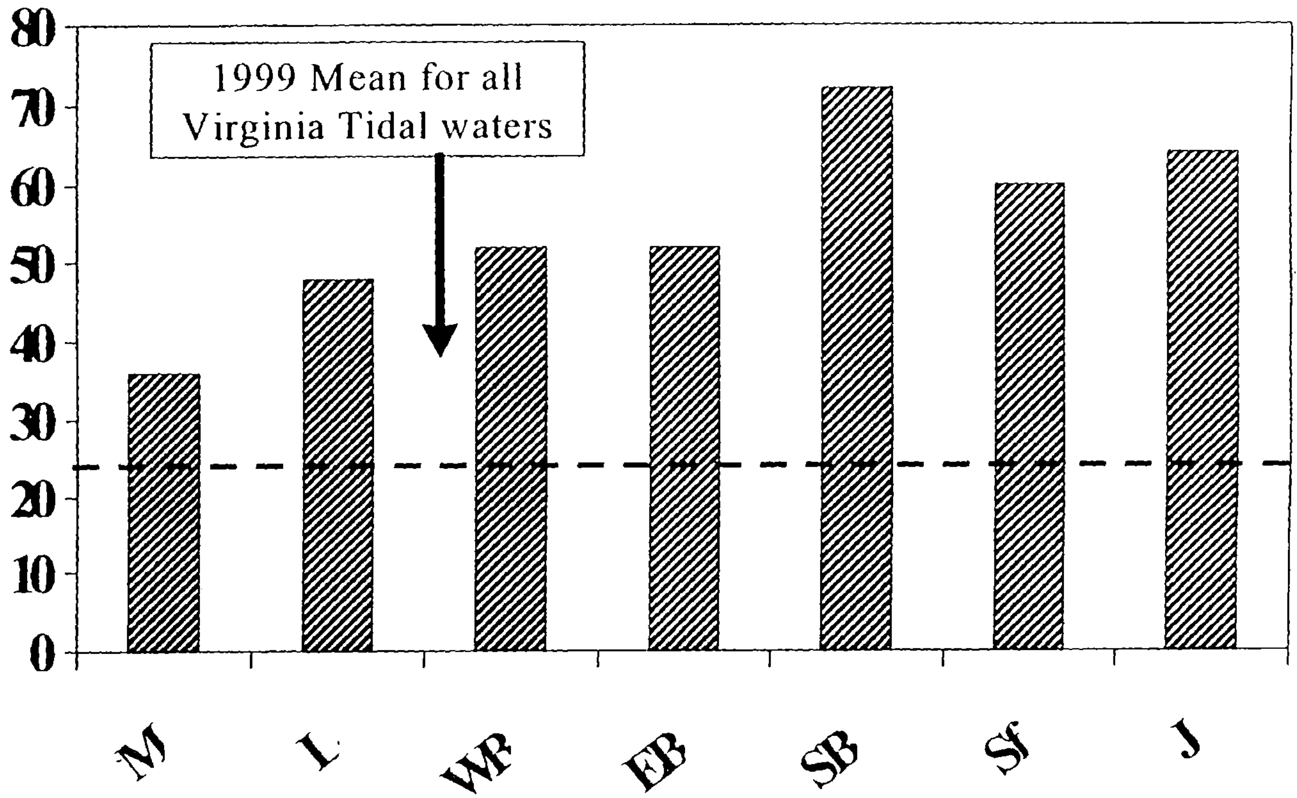


FIGURE 8

Summary of percent area of each stratum failing the Benthic Restoration Goals. Shown are degraded and severely degraded categories as defined in text. (D. DAUER, 2000)

Fishes. Direct evidence of the effects of pollutant stressors on the Elizabeth River fishes is provided by Hargis et al., (1984), Owen (1988), Roberts et al., (1988, 1989), and Bender et al., (1988).

These studies reported a high incidence of skin lesions, eroded fins and cloudy corneas in bottom fishes from the Southern Branch. Owen (1988) reported the incidence of external anomalies, primarily lesions, fin erosion and cataracts, to be 69 times higher in Southern Branch fishes than those from the Western Branch.

In toxicity tests conducted by Roberts et al., (1989), spot exposed to Southern Branch bottom sediment and interstitial sediment water displayed high acute mortality, fin erosion and internal and external lesions and cataracts. All spot exposed to 100% Southern Branch sediments taken near the creosote site died within two (2) hours. These effects were attributed to the heavy PAH contamination of the sediment. PAH concentrations in the Southern Branch sediments exceeded 21,000 ppm as opposed to the control sediments from the York River which were 2 ppm.

Vogelbein (2000) conducted a study of fish tissue in resident fish populations in the Elizabeth River as part of the Elizabeth River Monitoring Program (1998-99). In his report he indicates that "...hisopathological endpoints, especially those in the liver, are effective bioindicators of contaminant effects in Elizabeth River mummichogs, and can be used to characterize environmental quality. This is possible because the mummichog is largely non-migratory, with local sub-populations acting as effective integrators of bioavailble chemical contaminants. These fish thereby reflect the quality or health of the immediate environment in the types and severity of toxicant-induced pathologies present".

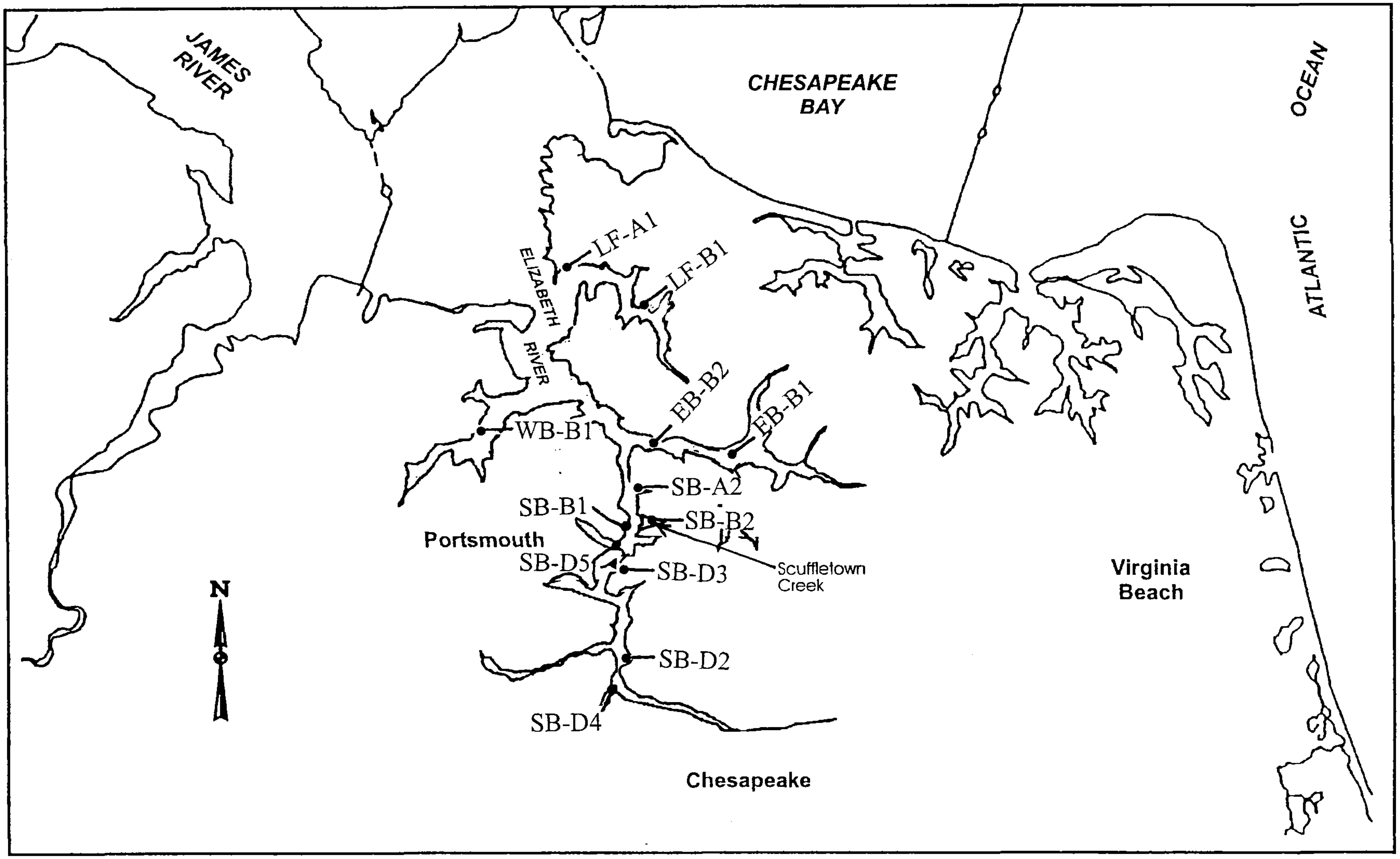
"Strongest most significant trends were apparent in the proliferative liver lesions which are considered to be indicative of exposure to chemical carcinogens present in localized environments. (Volgebein's) laboratory exposure studies with creosote contaminated sediments and PAH amended sediment and diet provide strong support to the view that this class of lesions arises specifically in the mummichog from environmental exposure to PAHs."

Based on examination of hepatic proliferative lesions in the mummichog, Volgebein used prevalence and severity of these alterations to rank the quality of twelve (12) study sites (Figure 9) in the Elizabeth River. Criteria for ranking study site quality was based on the occurrence of hepatic proliferative lesions as outlined in Table 7. Based on these criteria, rankings for the twelve (12) sites investigated are as follows:

Table 7. PROLIFERATIVE LIVER LESION BASED CRITERIA FOR RANKING THE QUALITY OF SELECTED ELIZABETH RIVER HABITATS (FROM VOGELBEIN, 2000)

Rank	Definition	Explanation	Station Location
0	Insufficient/ Inadequate Data	No fish or too few fish (<60) examined	(None)
1	Not a problem	Background liver lesions prevalences (pre-cancerous AHF[1] <5%, neoplasms[2] 0%). Most reference sites examined in other studies of mummichog pathology exhibit AHF prevalence 1-2%.	EB-B1 LF-B1 LF-A1 WB-B1
2	Borderline	AHF 5-20%, neoplasms 0%	SB-D5 SB-B2 (Scuffletown Ck.) SB-D4
3	A problem	AHF at moderate prevalence (20-30%) Neoplasms at low prevalences (<5%)	EB-B2 SB-D2 SB-A2
4	A severe problem	AHF at high prevalence (>30%) Neoplasms at high prevalence (>5%)	SB-B1 SB-D3

[1]AHF: Altered Hepatocellular foci are small precancerous liver lesions
[2]neoplasms: larger cancerous liver lesion that may be benign (adenoma) or malignant (carcinoma)
EB = Eastern Branch; SB = Southern Branch; WB = Western Branch; LF = Lafayette River



Note: SB = Southern Branch; EB = Eastern Branch; LF = Lafayette River; WB = Western Branch

FIGURE 9. MUMMICHOG (*FUNDULUS HETEROCLITUS*) SAMPLING STATIONS

Crabs. In addition to taking in toxics directly from the water, because adult crabs are large and long lived, they have the capacity to bioaccumulate toxics through their diet. Toxics are typically stored in the crab muscle and the hepatopancreas where they may reach levels considerably higher than in the surrounding water. The effects may include reduced growth and reproductive capacity, aberrant molting and death although there are no data on the frequency or severity of these effects in the Elizabeth River blue crab population.

While there is no data from which to estimate the health of the Elizabeth River blue crab population, it is apparent from the work of Alden and Winfield (1993) that Elizabeth River blue crabs carry a substantial body burden of pollutants. Recreational and commercial fishing in the river exposes consumers to the risk of cancer from PAH and PCB contaminated seafood.

Mothershead, et al., (1991) found that blue crabs from the Elizabeth River were found to be accumulating PAH-hydrocarbons, as well as chlorinated species including PCB's, and the pesticides DDE and Chlordane. The concentrations in the hepatopancreas were 3 to 4 times greater than in muscle tissue.

Wetlands Loss and Degradation

Historically, tidal wetlands within the Elizabeth River watershed have suffered significant losses from dredging, filling, and urban development. Nichols and Howard-Strobel (1991) provide an indication of the magnitude of wetlands loss with their estimate that the surface area of the Elizabeth River Basin was reduced by 26% between 1872 and 1982 through deposition of dredged material on marginal wetlands and subtidal bottoms. As much as 50 percent of tidal wetlands were lost on the Elizabeth River between 1944 and 1977 (Priest, 1999) (Table 8 and Figure 10). A recent study of wetlands loss in the Elizabeth River region reported losses of estuarine emergent and scrub-shrub marshes of just over 36 acres for the period from 1982 to 1989/90 (Tiner and Foulis, 1994). Less than 10% of the watershed remains undeveloped (Elizabeth River Project, 1992). The Elizabeth River's 350-mile shoreline has experienced extensive loss of wetlands and "vegetated buffers," natural areas which mix trees, shrubs and grasses. Vegetated buffers provide habitat, absorb runoff, trap sediments and filter pollutants. The vegetation also stabilizes the shoreline, takes up potentially harmful nutrients, improves aesthetics, improves air quality and controls flooding.

These losses of habitat and water and sediment quality degradation from pollution have led to significant impacts to the biota of the Elizabeth River that have compromised its value as an estuarine system (Birdsong et al., 1994).

Table 8. ELIZABETH RIVER WATERSHED
TIDAL WETLAND HABITAT LOSS: 1944-1977
(FROM PRIEST, 1999)

Tributary/Section	1944 Acreage	1977 Acreage	Acreage Lost	% Lost	Rate of Loss (ac/yr)
Willoughby Bay	214.20	80.41	133.79	62	4.05
Lafayette River	1076.80	488.04	588.76	55	17.84
Eastern Branch	1379.15	553.77	825.38	60	25.01
Southern Branch	2625.38	1360.14	1265.24	48	38.34
Western Branch	1074.43	612.01	462.42	43	14.01
Main Branch	293.14	118.66	174.48	60	5.29
Total	**6663.10**	**3213.03**	**3450.07**	**52**	**104.55**

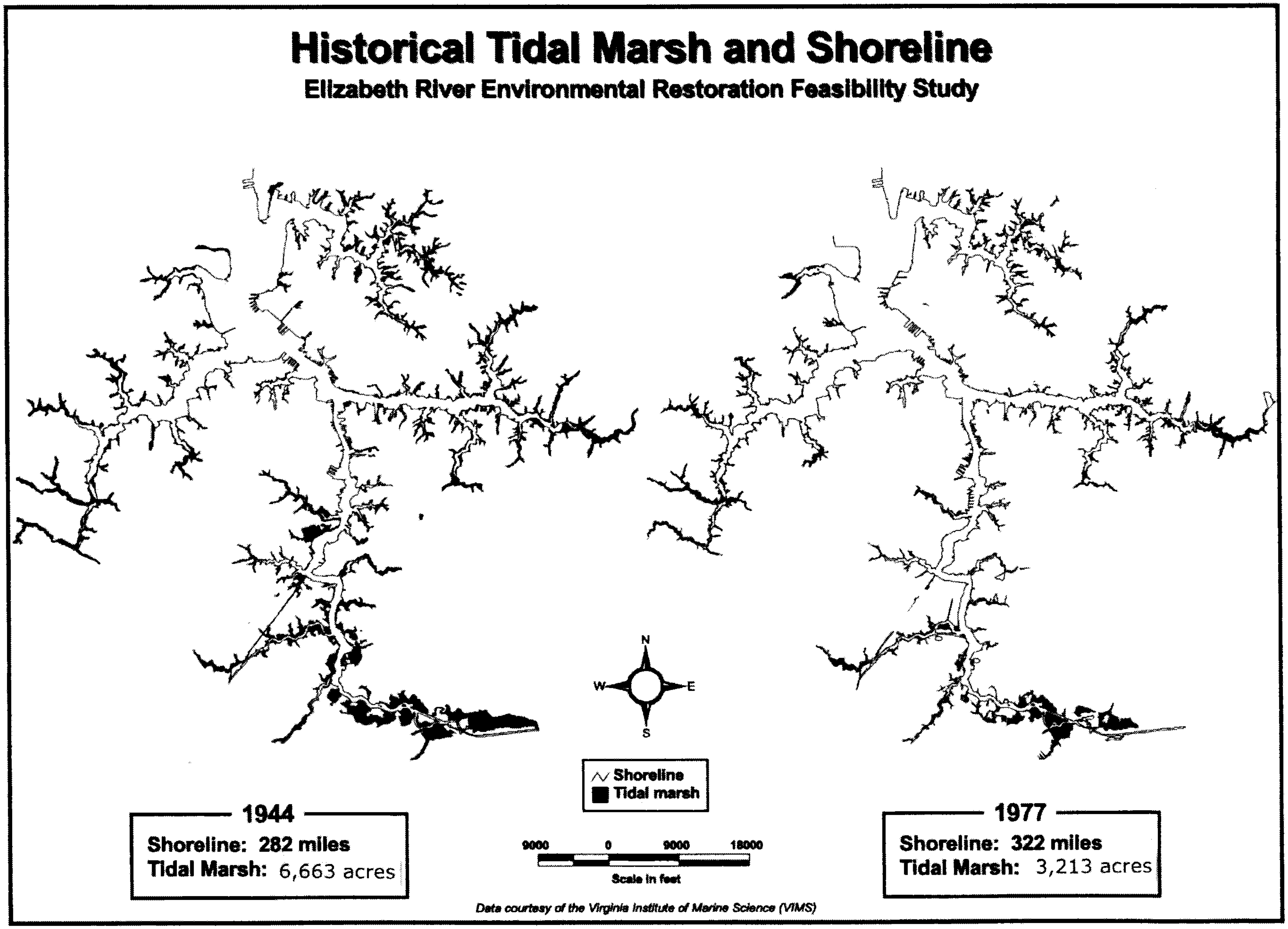

Historical Tidal Marsh and Shoreline
Elizabeth River Environmental Restoration Feasibility Study
N
W
E
S
Shoreline
Tidal marsh
1944
Shoreline: 282 miles
Tidal Marsh: 6,663 acres
9000 0 9000 18000
Scale in feet
1977
Shoreline: 322 miles
Tidal Marsh: 3,213 acres
Data courtesy of the Virginia Institute of Marine Science (VIMS)

FIGURE 10

How Environmental Degradation Took Place

"Environmental degradation, including loss of wetlands and bottom habitat deterioration related to sediment contamination, is the result of a long history of regional industrial, commercial, and residential development in the Elizabeth River watershed. Industrial use of the Elizabeth River started in the early 1600's with the construction of the first shipyard. Since that time, the river has been extensively developed by numerous industries. A map of a three mile segment of the Southern Branch depicting types of industries, both past and present, which surrounds the Atlantic Wood superfund site was developed by reviewing COE harbor maps dating back to the late 1800's and other historical documents. Types of pollutants associated with industries found along the river and documented by researchers to be present in sediments throughout the river include: heavy metals (i.e., cadmium, chromium, copper, lead, mercury, nickel, and zinc); organic compounds such as polynuclear aromatic hydrocarbons (PAHs), phthalates, PCBs, and tributyl tin (TBT).

Many of the industries found along the river were present since the early 1900's. Historic waste management practices, spills, and direct discharge of wastes to the Elizabeth River were commonplace and have led to widespread and extensive contamination of sediments. In addition to Atlantic Wood Industries, there have been three other creosote wood preserving facilities and one creosote bulk terminal located on the shores of the Southern Branch (Figure 11). Both the Wycoff Pipe and Creosote Company (immediately north of AWII) and the Eppinger and Russell Co. (one and a half miles upstream) were operating prior to 1900. Besides the historic waste disposal and discharge practices, the Eppinger and Russell site had a major fire in the 1960's which ruptured a tank, resulting in a massive spill of creosote into the river.

Other major industries which have been or are currently located on the river include shipbuilding and repairing. Discharges associated with this industry include numerous heavy metals and organics. In the 1940's and 50's the shores of the Southern Branch were lined with active fertilizer plants and this area was known as the fertilizer capital of the world. Typical pollutants discharged by these facilities included chromium, zinc, and excessive nutrients such as nitrogen and phosphorus. As shown in Figure 5, the river is also home to numerous bulk petroleum and chemical handling facilities. In 1981, the Elizabeth had bulk oil tank storage capacity in excess of 425,000,000 gallons. Many of these tank farms were present in the 1929 Corps of Engineers maps and have likely discharged PAH's and metals due to unloading operations, incidential spills, and intentional discharges prior to environmental regulation." (R. Worsham, Atlantic Wood Industries, Inc. letter to the Environmental Protection Agency (EPA), dated June 17, 1996)

National Priority List (NPL) Sites in the Elizabeth River

The EPA, in consultation with DEQ, has issued a Proposed Remedial Action Plan for Atlantic Wood Industries, Inc., a Superfund site located on the Southern Branch in Portsmouth (Figure 11). The site was listed on the National Priorities List (NPL) on February 15, 1990. Remedial actions include cleaning up surface soil, sediment and dense non-aqueous phase liquid contamination at the site (EPA, June 1995). With the exception of cleaning up sediments in a small inlet at the mouth of a storm drain, this effort does not immediately address the remediation of contaminated sediments located in the riverbed offshore of the site. The proposed Superfund plan indicates such action will be included in later steps. This is one of three designated Superfund sites on the river. The other two sites: U.S. Navy Shipyard in Portsmouth and St. Julians Annex in Chesapeake have also been added to the NPL within the last two years. All three of these sites are located on the Southern Branch of the Elizabeth River.

Superfund and various state programs may target isolated problems and responsible parties, but they do not address the historical and widespread impacts associated with activities that occurred decades and even a century or more ago in the river. These historical activities, such as the unregulated operation of creosote plants and the unrestricted filling of wetlands, are the major contributors to the habitat loss and degradation in the river evidenced today.

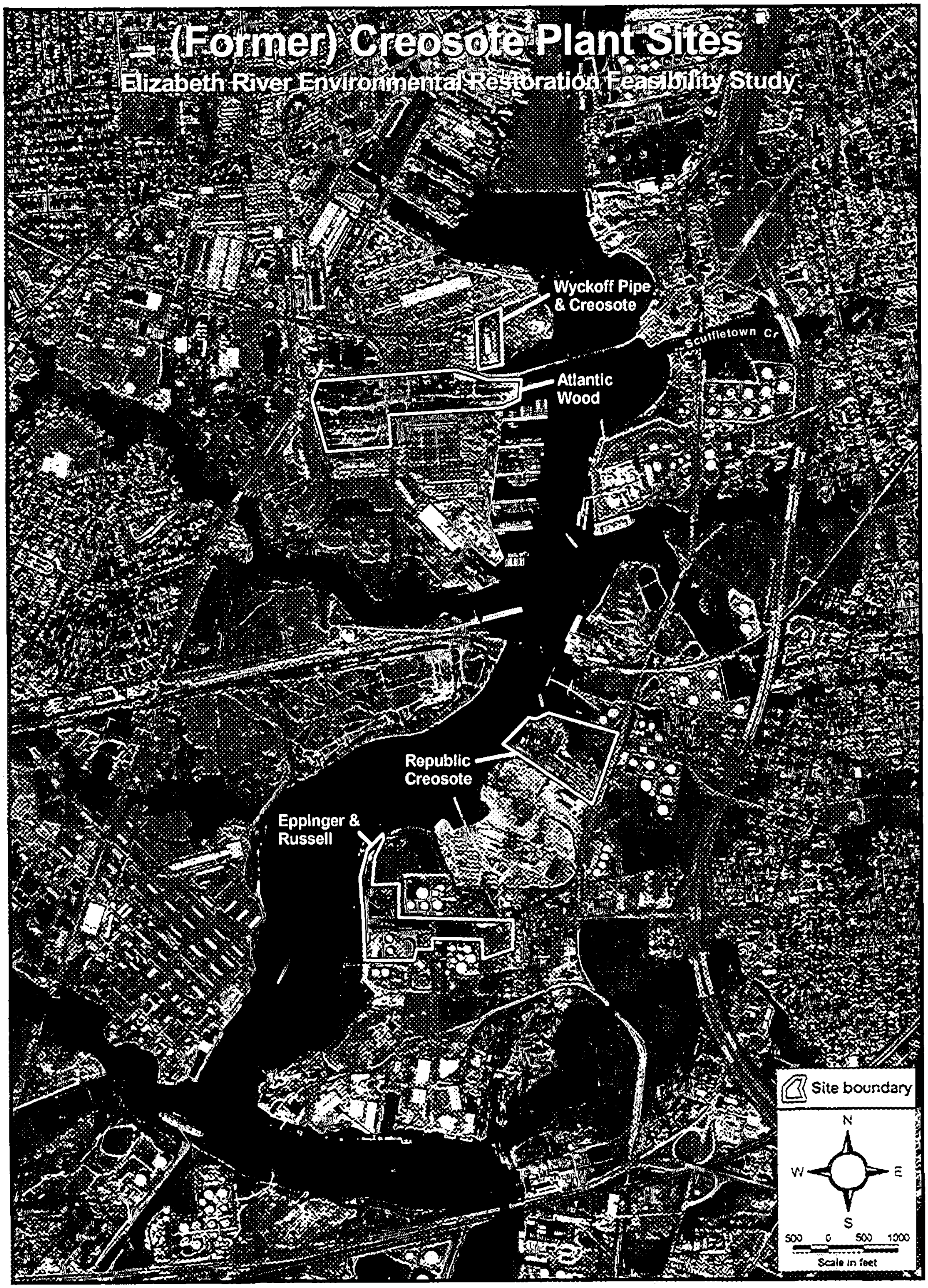

(Former) Creosote Plant Sites
Elizabeth River Environmental Restoration Feasibility Study
Wyckoff Pipe & Creosote
Scuffletown Cr
Atlantic Wood
Republic Creosote
Eppinger & Russell
Site boundary
N
W
E
S
500 0 500 1000
Scale in feet

FIGURE 11

V. FUTURE WITHOUT PROJECT CONDITION

WETLANDS

There are no specific large-scale wetland restoration programs or initiatives currently being pursued in the Elizabeth River. A primary goal of the Elizabeth River Project is to increase vegetated buffers and wetlands acreage, but no large-scale funded projects are currently identified. Since about 1980, most major construction projects in the watershed have required compensatory mitigation to offset tidal wetland losses. This policy has resulted in the construction of over 30 acres of tidal wetlands in the Elizabeth River since 1982. However, this is not considered "restoration" but rather an even tradeoff between habitat lost and habitat gained. Two individual one-acre wetland areas have been restored since1997 as cooperative efforts between the Elizabeth River Project, the city of Norfolk, and private citizens. Another planned restoration project will take place in the city of Chesapeake in 2001.

The expected future condition (Without Project Alternative or "No Action" plan) is a continuation of the present conditions, i.e., continued scarcity of wetland habitat leading to continued degradation and decline of environmental quality and suppression of aquatic resources in the Elizabeth River.

SEDIMENTS

There are no initiatives currently funded to do sediment clean-up in the Elizabeth River. The Virginia Legislature funded the Department of Environmental Quality to develop a long-term monitoring strategy in the Elizabeth River, but this program does not involve actual sediment clean-up, only limited monitoring of contaminate levels in the water, sediment, and organisms in the river. Creosote plants, which operated beginning in the early 1900's have been shut down, but the contaminants left behind are still prevalent in the sediments, some as pure "pools" of creosote (Mu Zhen Lu, 1982).

Contaminated sediment is found throughout the Elizabeth River, and high levels or "hot spots" are found in isolated areas near historical industry. These high levels of pollutants accumulating over centuries in the river sediments have been linked to health problems in fish, including tumors, cataracts and abnormalities, and may pose health risks for humans as well.

The Elizabeth River consists of evenly distributed silts and clays. Clay particles have a negative charge and metals are attracted to them. Metals also have a medium density and are more apt to distribute before settling. This contributes to the even distribution of metal contamination within the Elizabeth River and the lacking of distinct hot spots. Sampling data by Alden (1991) and the Corps confirm evenly distributed metal contamination throughout the Southern Branch.

The expected future condition (Without Project Alternative or "No Action" plan), aside from a possible sediment clean-up related to the Atlantic Wood Superfund site, is a continuation of the present conditions, i.e., continued high levels of contaminants found in the sediments. This will lead to continued degradation and decline of environmental quality in the Elizabeth River as these sediments (and contaminants) impact benthos and are resuspended as a result of storms, dredging, ship movement, and other related events.

VI. PROBLEMS, NEEDS, AND OPPORTUNITIES

In 1993, the Chesapeake Bay Program identified the Elizabeth River as a "Region of Concern", targeting it as one of three sites in the Bay watershed where contaminants pose the greatest threat to natural resources. In its Watershed Action Plan, the Elizabeth River Project identified the "high risk" problems of the river as sediment contamination, wildlife habitat loss, and point source and non-point source pollution. There is general consensus that the two primary problems of the river are sediment contamination and the loss of available wildlife habitat. These two problems have placed tremendous stress on the living resources of the Elizabeth River and "compromised the river's value as an estuarine system" (Birdsong et al., 1994).

Environmental degradation, including loss of wetlands and bottom habitat deterioration related to sediment contamination, are the result of a 200-year history of regional industrial, commercial, and residential development in the Elizabeth River watershed as shown by the photograph in Figure 12. Over that period of time, the river has been extensively developed by numerous industries, including creosote plants, shipbuilding and repair facilities, fertilizer plants, and petroleum and chemical handling facilities.

Historic waste management practices, spills, and direct discharge of wastes to the river were commonplace and, in combination with urban storm water runoff, have led to the widespread and extensive contamination of bottom sediments. The types of pollutants associated with these industries and documented by researchers to be present in sediments throughout the Elizabeth River include heavy metals, including cadmium, chromium, copper, lead, mercury, nickel, and zinc; and organic compounds, including polynuclear aromatic hydrocarbons (PAHs), phthalates, PCBs, and tributyl tin (TBT).

FIGURE 12. INDUSTRIAL DEVELOPMENT ON THE SOUTHERN BRANCH

VII. PLAN FORMULATION

INTRODUCTION

This section of the report presents the rationale for the development and refinement of the National Ecosystem Restoration (NER) plan for environmental restoration in the Elizabeth River. The formulation and evaluation of possible alternatives are conducted in accordance with the U. S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, dated 10 March 1983, and related guidance including ER 1105-2-100, dated April 2000 (Planning Guidance). In accordance with the Principles and Guidelines and the Planning Guidance, alternatives were screened to arrive at plans most responsive to the problems and needs of the particular areas, giving consideration to their contribution towards the enhancement of the National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). Corps guidance on the National Ecosystem Restoration (NER) objective is found in ER 1105-2-100.

PLAN FORMULATION PROCESS

A federally funded (expedited) reconnaissance study conducted in FY 1997/1998 determined the need for environmental and other interrelated activities required to restore the Elizabeth River. The 905(b) Analysis Report (Reconnaissance Study) was approved by COE Headquarters on 13 November 1997, and the Project Study Plan was certified on 10 April 1998. As stated in the HQ approval letter: "… projects that involve dredging of contaminated sediments must be consistent with Section 312 of WRDA 1990, as amended and Corps of Engineers Implementation Guidance for Section 312 dated 25 April 2001. The wetland restoration measure should be formulated consistent with ecosystem restoration guidance in ER 1165-2-501."

The purposes of this section are to provide background on the criteria used in the plan formulation process of environmental restoration and protection alternatives for the Elizabeth River study area and to present the procedures followed from identification of the study objectives to designation of a selected plan of improvement. The formulation process involved establishment of plan formulation rationale, identification and screening of potential solutions, and assessment and evaluation of detailed plans which are responsive to the identified problems and needs.

Ecosystem Restoration – Federal Objectives

The general guidance in the P&G applies to ecosystem restoration activities and will be used in formulating and evaluating the ecosystem restoration projects for the Elizabeth River. Plans to address ecosystem restoration will be formulated and recommended, based on their monetary (if applicable) and non-monetary benefits. Unlike traditional civil works water resources projects, the ecosystem restoration efforts for the Elizabeth River need not exhibit net national economic development (NED) benefits. The Federal objective of ecosystem restoration is the production of environmental quality (EQ) benefits. An incremental cost analysis was performed to determine the most cost effective ecosystem restoration project using the following documents: "Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps", IWR Report 94-PS-2; and "Evaluation of Environmental Investments Procedures Manual: Cost Effectiveness and Incremental Analysis", IWR Report #95-R-1.

Priority has been assigned to the restoration of ecosystems and associated ecological resources. Therefore, consistent with the analytical framework established by principles and guidelines for water resources studies, plans to address ecosystem concerns may be recommended, based upon their monetary and non-monetary benefits. Some examples of policy statements that show ecosystem restoration as a Federal priority are included in the following paragraphs.

ER 1165-2-501 dated 30 September 1999 states that "...Ecosystem restoration is one of the primary missions of the Civil Works program. The purpose of Civil Works ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded." EP 1165-2-502 dated 30 September 1999 (paragraph 7 c.) further states that "...Civil Works ecosystem restoration initiatives attempt to accomplish a return of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions. In some instances a return to pre-disturbance conditions may not be feasible. However, partial restoration may be possible, with significant and valuable improvements made to degraded ecological resources."

Plan Formulation Evaluation Criteria

Significance. The significance of ecological resources is based upon their monetary (NED) and non-monetary (EQ) values which must be identified and clearly described.

- Monetary – Contribution the resource(s) make to the Nation's economy
- Non-monetary – Technical, institutional, and public recognition of ecological, cultural, and aesthetic attributes of resource(s).

Technical - Based on scientific or technical knowledge or judgement of critical resource characteristics.

Institutional - The importance of an EQ resource is acknowledged in the laws, adopted plans such as national or international agreements, or other policy statements of public agencies or private groups.

Public Recognition - Some segment of the general public recognizes the importance of an EQ resource or attribute.

Scarcity. Scarcity or uniqueness of resource from national, regional, state, and local perspective. Scarcity of the resource contributes to the value of the restored habitat and is usually described in terms of the amount of the similar habitat that is known to have existed in the past.

Views of the Non-Federal Sponsor. The willingness of the non-Federal sponsor to share study and project costs and the general concurrence of state and Federal resource agencies and environmental community are strong indicators of the reasonableness and worthiness of the recommended action.

Additional Criteria.

Acceptability – Acceptable to State and Federal resource agencies; broad public support; acceptable to non-federal cost sharing sponsor

Completeness – Account for all investments for realization of benefits

Efficiency – Cost effective

Partnership Context – Priority given to projects where another Federal agency utilizes their authority and funding

Reasonableness of Costs – Even after tests of cost effectiveness and incremental cost analysis, the decision-maker must ascertain that the benefits are really worth the costs.

PLANNING PROCESS

The emphasis of this environmental restoration study is to evaluate alternatives to meet the study goals and display a range of costs and benefits resulting from the various measures which could be utilized to produce the outcomes to address the restoration goals. Through the evaluation and coordination process, the partnership of the USACE, Norfolk District, and the sponsors will develop a range of alternatives to produce benefits that address the restoration goals. The outputs are measured as the net difference between the future with, and the future without, for the various alternatives.

STUDY OBJECTIVE

The overall objective of this investigation is:

- to address two major environmental problems in the Elizabeth River Basin: wetlands loss and degradation and bottom sediment contamination;
- to address measures that will improve the situation;
- to determine the feasibility of and Federal Interest in implementing the proposed solutions of wetlands restoration and sediment clean-up/restoration; and
- to ensure that the plans developed are environmentally and socially acceptable, technically feasible, and economical.

For the initial feasibility study and as presented in the 905(b) Analysis, Scuffletown Creek was selected for intensive sediment contamination investigation. It was determined during the reconnaissance study that intensive evaluations at four sites would be cost-prohibitive for one feasibility study effort. This was strongly endorsed by the non-Federal sponsors. The three other sites (Scotts Creek, the Eastern Branch in the vicinity of Campostella Bridge, and a site adjacent to a former creosote plant, Eppinger and Russell on the Southern Branch) were less intensively evaluated during this initial feasibility study. The information derived from these three sites will be used to prioritize them for future, more intensive, feasibility-level characterization and sediment remediation studies (Figure 13).

ELIZABETH RIVER ENVIRONMENTAL RESTORATION

SEDIMENT RESTORATION STRATEGY

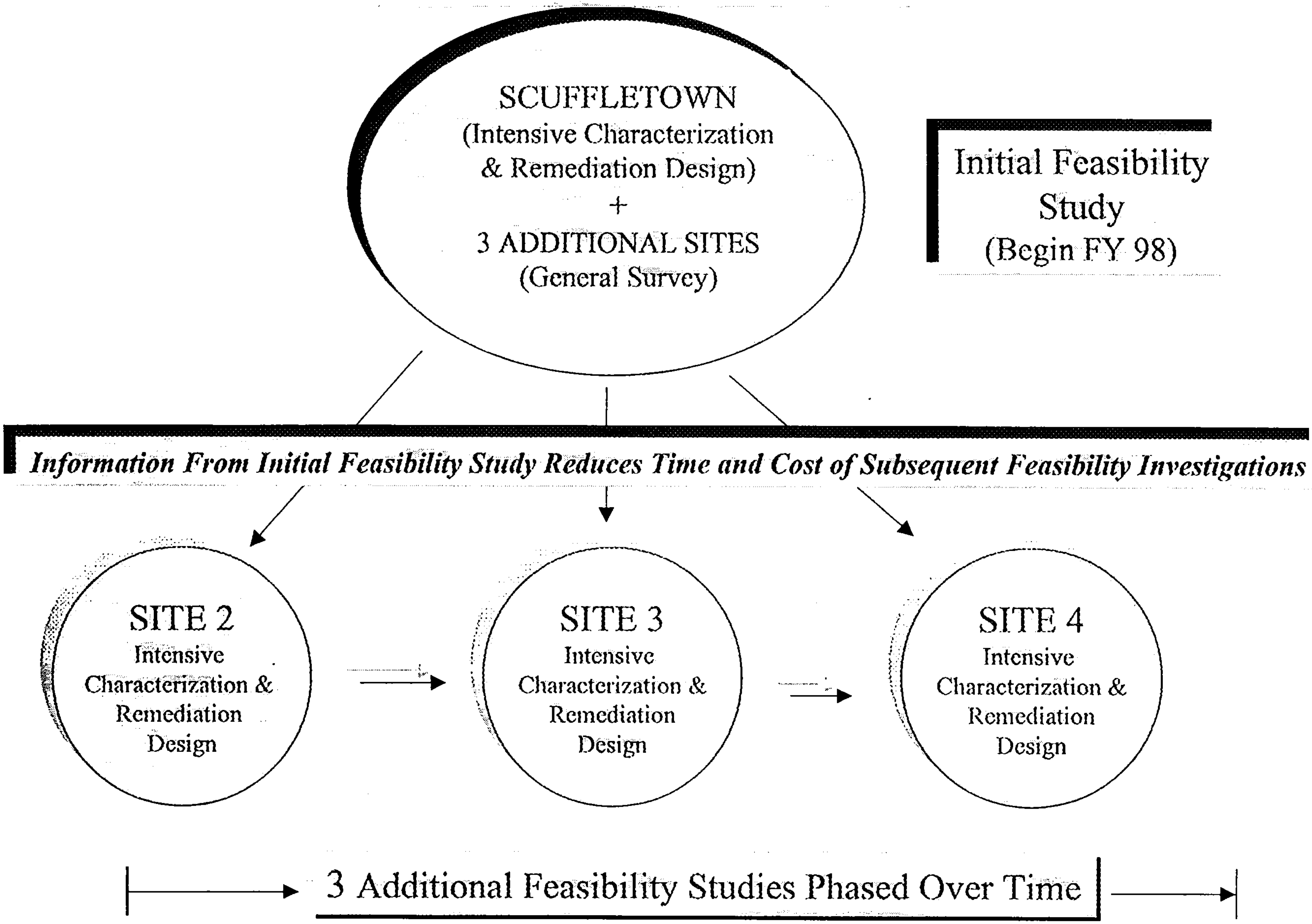


FIGURE 13. COMPREHENSIVE SEDIMENT RESTORATION STRATEGY

PLANNING CONSTRAINTS AND PROBLEMS

Planning constraints are any policies, technicalities, or other considerations that have the capacity to restrict or otherwise impact on the planning process. For this reason, the identification and appraisal of alternative plans is accomplished with consideration for potential constraints to their implementation. There are several significant constraints that must be considered in this investigation. A summary of the formulation and evaluation criteria for environmental restoration options utilized in this study is presented in subsequent paragraphs. These criteria involve physical, economic, environmental, and social factors that tend, in varying degrees, to constrain the options and/or ultimate selection of a restoration plan or plans for the Elizabeth River. Although all of the formulation and evaluation criteria were considered for the various alternatives, key factors or constraints can be further summarized as follows:

- Restoration projects should have a useful life span of about 50 years,;
- Costs associated with a restoration plan should be minimized;
- Impact to bottom lands, wetlands, coastal zones, and wildlife resources in the Elizabeth River area will be minimized;
- Restoration projects are designed to provide overall net benefits to the environmental quality of the Elizabeth River area; and
- Any potential adverse social and historical impacts associated with constructing the proposed restoration projects should be minimized.

FORMULATION AND EVALUATION CRITERIA

Introduction

Technical, economic, and environmental criteria, in addition to intangible considerations, permit the development and selection of a plan that best responds to problems and needs of an area. Criteria developed for the purpose of this investigation are discussed in the following paragraphs.

The USACE, Norfolk District, is pursuing the implementation of the sediment remedial action and wetlands restoration in the Elizabeth River. Wetland restoration projects are formulated consistent with guidance contained in ER 1105-2-100 (Plan Formulation), Ecosystem Restoration in the Civil Works Program. Sediment restoration projects have been evaluated consistent with Section 312 of the Water Resources Development Act (WRDA) of 1990; Environmental Dredging, as amended by Section 205 of the Water Resources Development Act of 1996; Section 224 of WDRA 1999; and as promulgated by Corps of Engineers Implementation Guidance for Section 312 dated 25 April 2001, and Engineer Regulation (ER) 1165-2-500 (Civil Works Ecosystem Restoration Policy).

Ecosystem Restoration

Section 312 of the Water Resources Deveiopment Act (WRDA) of 1990, entitled: "Environmental Dredging", authorizes the Secretary of the Army to remove contaminated sediments from the navigable waters of the United States. Section 312(a) provides for removal of contaminated sediments outside the boundaries of and adjacent to a Federal navigation project as part of the operation and maintenance of the project. The costs of removal of the contaminated sediments must be economically justified based on savings in future operation and maintenance costs defined as those associated with reduction in dredging and disposal costs through the elimination of a source of contamination. Implementation of Section 312(a) will require agreement by a non-Federal sponsor to provide all costs related to the disposal of contaminated sediments.

Section 312(b) provides for removal of contaminated sediments for the purpose of environmental enhancement and water quality improvement, if such removal is requested by a non-Federal sponsor and the sponsor agrees to pay 35 percent of the cost of removal and 35 percent of the cost of disposal (as amended by Section 224 of WRDA 1999).

Section 312(b) provides dredging authority for contaminated sediment removal and ecosystem restoration provided that projects are evaluated and justified as ecosystem restoration projects under the guidance contained in ER 1165-2-501. The COE may appropriately consider ecological restoration measures if the measures pertain to traditional water and associated land resources, and measures are associated with restoration of ecological structure and function (Corps of Engineers Implementation Guidance for Section 312 dated 25 April 2001, and ER 1165-2-501).

An ecosystem restoration-based evaluation for removal of contaminated sediments at Scuffletown Creek was required to establish justification for the entire project under Section 312(b). This evaluation is included in following sections of the report and in Benefits Analysis, Appendix C. Procedures developed by the Elizabeth River Sediment Subcommittee to measure the ecosystem restoration benefits under the Section 312(b) authority were used. The outputs are the things measured; the benefits are the values given to those measurements. This methodology is appropriate and consistent with the intent of ER 1165-2-501 to utilize appropriate indicators and units to measure the quality and/or quantity of the habitat-related outputs and associated benefits. In addition to applying these procedures to measure outputs, a recommendation for COE involvement was justified based on an overall determination that benefits exceed costs. This determination was based on the following tasks, as outlined in ER 1165-2-501:

a. Establish the importance and value of the ecosystem and the study objectives.
b. Estimate costs and benefits in monetary and non-monetary terms.
c. Evaluate alternatives via application of cost effectiveness and incremental cost analysis.

Technical Criteria

The following technical criteria, within a planning framework, were adopted for use in plan formulation. It corresponds to Federal guidelines that are comprehensive.

a. The plan should be consistent with local, regional, and state goals for water resources and related land development.
b. The plan should be technically feasible to implement.

Economic Criteria

The economic criteria that were applied in the formulation of the alternative plans are essentially as follows:

a. In accordance with the overall objectives of the study, the plan should:

1. Minimize the total cost including investment, operations, maintenance, and replacement.
2. Minimize the overall economic impact on the surrounding area.

b. Alternative plans will be compared on the basis of a cost effectiveness and incremental cost analysis. Cost to be considered in the analysis should include, but not be limited to, the following:

1. Construction cost
2. Interest during construction
3. Lands and damages, easements, rights-of-way, relocations, and disposal areas
4. Average cost of operation and maintenance and/or major replacement costs

c. To be consistent with planning horizons on Federal navigation projects, alternatives will be compared using an economic life approaching 50 years.
An assessment of detailed plans was compared using FY 2001 price levels and a discount rate of 6-3/8 percent.

e. Appropriate risk and uncertainty analyses will be required to determine the economic sensitivity of the various economic variables. These could include such items as increases in cost of construction material required, etc.

Environmental and Social Criteria

Environmental and social criteria considered throughout the study include the following:

a. The plan should minimize the commitment of natural resources, whether they are marine bottom-lands, wetlands, other coastal zones, inland environments, or wildlife in these areas.

b. The plan should maximize the restoration of environmental quality in the Elizabeth River considering environmental, economic, and engineering criteria.

c. The available sources of expertise should be used to identify environmental resources that might be endangered, damaged, or destroyed by plan implementation. These would include the U. S. Fish & Wildlife Service (USFWS), EPA, National Marine Fisheries Service (NMFS), and appropriate state agencies such as Virginia Institute of Marine Science (VIMS), Virginia Marine Resources Commission (VMRC) and the Virginia Department of Historic Resources.

d. Measures should be incorporated into the recommended plan to protect, preserve, restore, or enhance environmental quality in the project area.

e. The plan should be capable of being integrated into local or regional planning for water and air pollution abatement, transportation, recreation, and land use.

f. As much as possible, the plan should minimize noise, dust, odor, unsightliness, and potential health risks.

g. The plan should meet existing public health and environmental control standards.

h. As nearly as possible, the plan should be esthetically pleasing to the public, which has to support and live with it.

i. The plan should not displace, devalue, or destroy important historical and cultural landmarks or sites.

j. The adverse impacts on area recreation resources should be minimized.

k. The plan should be publicly acceptable.

The degree to which any environmental restoration project meets the foregoing criteria is taken as a measure of its relative merit. Clearly, no restoration option could meet all these criteria fully. However, the evaluation, selection, and development of alternatives will emphasize optimization in terms of the respective environmental benefits along with the consideration of social and regional impacts.

POSSIBLE SOLUTIONS

Initial Screening of Alternatives - Wetland Sites

The 905(b) Analysis (Reconnaissance Study) recommended that nineteen candidate wetland sites be evaluated for restoration feasibility. During the feasibility investigations some of these sites were discontinued and others were added to the list as shown in Table 9. The following is a listing of why some of the candidate site development was discontinued.

1. Private Property Issues. After search of real estate records, and discussions with the cities, it was determined that several of the candidate sites were held exclusively by private property owners; some of which are held by multiple owners. In meetings with the non-Federal sponsors it was determined that they were reluctant to pursue wetland restoration on privately held land. At the direction of the non-Federal sponsors and at the discretion of the Steering Committee, the COE was directed to drop sites where it appeared likely that private property issues could become problematic.

2. Site Constraints. Several sites were discontinued because site constraints such as buildings, public roadways, utilities, private property, etc., did not allow adequate land or space to develop a wetland restoration project at the site (i.e., although Portsmouth plans to acquire property from Scotts Creek to Constitution Ave. for an ecological buffer, the property has a large elevation difference (± 15 feet) from mean high water with narrow constraints (i.e., London Blvd. and North Street on either side). Thus grading down to a required elevation for marsh development would result in undesirable steep embankments.)

3. Landfill Sites. Wetland restoration was considered at two former landfill sites. Site investigations were performed to determine that wetland restoration would require excavation within landfill. Concern was expressed by non-Federal sponsors that excavation to restore wetlands may uncover unknown fill materials and may compromise site. At the direction of the non-Federal sponsors, these sites were discontinued.

4. Subsurface Soils/Former Land Use. After searching the history of the sites, it was determined that Swimming Point (Portsmouth) was the location of a (former) manufactured gas plant (MGP). The former Portsmouth Gas Company, which was located to the southwest of the site, operated the MGP from 1856 to 1956. In 1992, the Virginia Department of Environmental Quality (DEQ) received Phase I and Phase II Environmental Assessments prepared in connection with the sale property adjacent to the site. Petroleum hydrocarbons and semivolatile organic compounds were detected in soil samples collected from bore-holes advanced on the property. In April 1995, a recovery well was installed at the old MGP site. A 20 October 1998 progress report states that 459.18 gallons of product have been removed from the subsurface. Petroleum hydrocarbons and semi-volatile organic compounds were detected during COE subsurface soils investigations in November 1999. The Wetlands Subcommittee recommended that this site be discontinued because wetland restoration may create a more efficient conduit for these products to enter the river.

5. Loss of Habitat. A site was evaluated at Great Bridge Locks Park, Chesapeake. The candidate site lies along the shoreline of a public park. The existing shoreline is vegetated with large trees and under-story vegetation. Wetland restoration at the site would require removal of the existing vegetation and some grading of the bank area. The Wetlands Subcommittee recommended against removal of this riparian buffer as it is already a functioning habitat of value. Further wetland restoration development of the site was therefore discontinued.

6. Stormwater Concerns. The Kings Creek site in Virginia Beach was dropped from further investigation because of stormwater management issues at Military Highway and Indian River Roads. The headwaters of the creek receive a significant volume of

stormwater from adjacent roadways. This has resulted in sediment buildup and common reed (*Phragmites*) infestation. Because complex stormwater issues are unresolved, the city recommended further wetland restoration development of the site be discontinued.

Table 9. ELIZABETH RIVER ENVIRONMENTAL RESTORATION WETLAND SITES FEASIBILITY STATUS

Site Locations Investigated	City	Feasibility Status
1. Great Bridge Locks Park	Chesapeake	Site investigation discontinued – valuable riparian habitat would have to be graded to create wetland
2. Scuffletown Creek	Chesapeake	Surveys, Cost Est. and Preliminary Design completed
3. Western Branch Park	Chesapeake	*Phragmites* (common reed) control
4. (Former) Municipal Landfill Site, North of Municipal Center, Great Bridge	Chesapeake	Site investigation discontinued – former landfill; excavation and related regulatory concerns
4. East of Campostella Bridge/Site 1	Norfolk	Site investigation discontinued – private property issues
5. East of Campostella Bridge/Site 2	Norfolk	Site investigation discontinued – private property issues
6. East of Chesterfield Heights (Grandy Village)	Norfolk	Surveys, Cost Est. and Preliminary Design completed
7. Lamberts Point/Drainage Channel	Norfolk	Site investigation discontinued – former landfill; excavation and related regulatory concerns
8. Harbor Park Shoreline	Norfolk	Site investigation discontinued – site constraints
9. Tidewater Dr. @ Lafayette River (Somme Avenue)	Norfolk	Surveys, Cost Est. and Preliminary Design completed
10. West of Old Dominion University (ODU Drainage Canal)	Norfolk	Surveys, Cost Est. and Preliminary Design completed
11. Mouth of Steamboat Creek	Norfolk	Site investigation discontinued – already a functioning wetland; debris removal only
12. Portsmouth City Park	Portsmouth	Surveys, Cost Est. and Preliminary Design completed
13. Northwest side Jordan Bridge (old Wycoff Pipe)	Portsmouth	Surveys, Cost Est. and Preliminary Design completed
14. Paradise Creek (throughout)	Portsmouth	Site investigation discontinued – private property issues; *Phragmites* (common reed) control
15. Scotts Creek (3 sites)	Portsmouth	1. Surveys, Cost Est. and Preliminary Design completed for one site **(Sugar Hill)**
		2. London Blvd. – discontinued - narrow site constraints/ high elevation make wetland restoration infeasibile 3. W. Park View – discontinued due to private property issues

BOLD = Preliminary design, cost estimate, completed

Table 9. (cont'd) ELIZABETH RIVER ENVIRONMENTAL RESTORATION WETLAND SITES FEASIBILITY STATUS

Site Locations Investigated	City	Feasibility Status
16. Crawford Bay	Portsmouth	Surveys, Cost Est. and Preliminary Design completed
17. Swimming Point	Portsmouth	Site investigation discontinued – subsurface soils investigations uncovered petroleum product contamination related to prior industrial use of site
18. Indian R. Rd. & Military Hwy. (Kings Creek)	Virginia Beach	Site investigation discontinued – complex stormwater concerns; site constraints
19. City Park (Woodstock)	Virginia Beach	Surveys, Cost Est. and Preliminary Design completed
20 Elizabeth R. Shores	Virginia Beach	Site investigation discontinued – multiple private property owners
21. Carolanne Farm Park	Virginia Beach	Surveys, Cost Est. and Preliminary Design completed
22. I-64 Crossing of E. Branch (Lancelot Dr./Avalon Hills)	Virginia Beach	Preliminary Design completed; Right-of-entry not granted – no surveys completed

BOLD = Preliminary design, cost estimate, completed

Initial Screening of Alternatives – Sediment Sites

The 905(b) Analysis recommended that five candidate sediment sites be evaluated during the feasibility study:

1. Scotts Creek - South Branch Headwaters. Scotts Creek is located in the city of Portsmouth and drains into the main stem of the Elizabeth River from the west bank. Three major stormwater outfalls, which drain over 800 acres of industrial and commercial property, empty into headwaters of the south branch of Scotts Creek at London Boulevard. Siltation and smothering of existing wetlands and the contaminants associated with stormwater are major problems.

2. Paradise Creek. This creek is a tributary to the Southern Branch of the Elizabeth River and is located in the cities of Chesapeake and Portsmouth. Situated on the west bank approximately 2-1/2 nautical miles from the Eastern Branch/Southern Branch confluence, it lies adjacent to the Naval Shipyard property and two former creosote plants which constitute much of the drainage area into the creek.

3. East of Campostella Bridge. This site is located on the Eastern Branch approximately 1-3/4 nautical miles from the Eastern Branch/Southern Branch confluence. It is situated in a small cove just east of the Campostella Bridge and adjacent to the Campostella Heights neighborhood in the city of Norfolk. Ship repair facilities are located directly across the river (Norfolk Shipbuilding and Drydock) and upriver (Colonna Shipyard).

4. Scuffletown Creek. This creek is a tributary to the Southern Branch of the Elizabeth River and is located on the east bank approximately two nautical miles from the Eastern Branch/Southern Branch confluence in the city of Chesapeake. Located on the opposite shore, less than 1/2 mile across the river, are two former creosote plants, Atlantic Wood Industries and Wycoff Pipe and Creosote which operated from the 1920's. Atlantic Wood is a superfund site currently under remedial action. The Wycoff property is owned by Portsmouth Port and Industrial Authority. A city park is located at the mouth of the creek.

5. (Former) Eppinger and Russell (E&R). This site is located on the Southern Branch of the Elizabeth River, east bank, approximately three nautical miles south of the Eastern Branch/Southern Branch confluence, in the city of Chesapeake. The general area (known as Money Point) has a long history of creosote wood treatment starting around the turn of the century. Wastewater containing creosote was directly discharged into the Elizabeth River before the Korean War (1950-1953). A fire at the E&R plant in 1963 resulted in a spill of creosote into the Elizabeth River. In 1967, ruptured tanks resulted in the drainage of 20,000 to 30,000 gallons of creosote into the river (Mu Zhen Lu, 1982).

During the course of the feasibility investigations, it was determined that Paradise Creek may be included as part of a remedial action at the U.S. Naval Shipyard and Atlantic Wood Industries (both in Portsmouth) under Superfund. Both are National Priority List (NPL) sites. Paradise Creek receives discharges and stormwater drainage from the Navy's landfills and Atlantic Wood's outfall 003. Because of the possibility that Paradise Creek may become subject to a Superfund clean-up effort, it was the recommendation of the Sediment Subcommittee that the site be dropped from further investigation in this feasibility study. This recommendation was endorsed by the Steering Committee. As recommended in the 905b(b) analysis, of the four remaining sites, three would receive a preliminary characterization and one (Scuffletown Creek) would receive intensive evaluation for a proposed clean-up effort under Section 312(b) of WRDA 1990, environmental dredging, as amended. Figure 14 shows the locations of the four sediment sites that were carried forward for further evaluation.

Possible Solutions - Sediment Clean-up

As part of the plan formulation process, an array of scenarios was considered to address the clean-up of contaminated sediments and restoration of disrupted habitats. All scenarios were evaluated assuming the clean-up took place solely under the 312(b) authority.

The Elizabeth River Steering Committee formed a Sediment Subcommittee to develop the technical aspects of sediment evaluation and to evaluate potential restoration solutions. This Subcommittee includes the U.S. F&WS, Virginia DEQ, and scientists from VIMS and ODU. The COE also convened a "Scuffletown Dredging Team" comprised of District scientists and engineers evaluating the engineering and environmental aspects of the potential clean-up solutions. Clean-up scenarios considered during initial screening of alternatives ranged from "No Action", to containing sediment in place (capping), to in-situ treatment, to dredging scenarios that included shallow dredging, and deeper dredging, or a combination of dredging and capping (Table 10).

Table 10. INITIAL SCREENING OF SEDIMENT REMEDIATION ALTERNATIVES

Contaminated Sediment Remediation Alternatives	Results	Action
1. "No Action"	Continuation of degraded conditions: sediments toxic to aquatic organisms; fish abnormalities, depressed bottom dwelling community health, elevated contaminate levels, widespread migration of contaminated sediments	N/A
2. Contain Sediment in Place (Capping)	Not practical in shallow water; may be feasible after some contaminated sediment is removed	Retain as a possible post-(shallow) dredging option
3. Treat Sediment in Place	Not practical: difficult to insure all contaminants treated; not demonstrated effective on large scale	Drop
4. Environmental Dredging-Remove (dredge) and contain dredged material	Demonstrated to be effective on large scale; tried and proven technology	Retain for further design and cost analysis
5. Environmental Dredging-Remove (dredge) and treat dredged material	Demonstrated to be effective on large scale; tried and proven technology	Retain for further design and cost analysis

Alternatives that were assessed after the initial screening pertained to dredging technologies, dredging scenarios, transfer/dewatering options, treatment technologies, transportation to a disposal site and eventual disposal of dredged sediment at a dredged material placement site and/or a regulated solid waste landfill site. These alternative plan components were subsequently considered in various potential combinations, and progressively evaluated by USACE, Norfolk District's, "Scuffletown Dredging Team" and the Sediment Subcommittee. Alternatives were assessed for engineering and economic feasibility, and environmental and social acceptability. The details of the process are discussed in some detail in the following narrative.

FIGURE 14

Wetland and Sediment Sites

Cities of Chesapeake, Norfolk, Portsmouth, & Virginia Beach

Elizabeth River Environmental Restoration Feasibility Study

Environmental Dredging - Plan Component Assessments/Evaluations

A wide array of alternatives and/or components pertaining to dredging, transfer/dewatering, treatment technologies, transportation, and disposal of dredged sediment were considered during the evaluation process. The Project Plan would consist of a number of component parts or actions. These component parts or actions were subsequently considered in various potential combinations (Plan Alternatives) and evaluated in order to identify a tentatively Recommended Plan or plans. This process is discussed in the following subsections.

Dredging Technologies Component

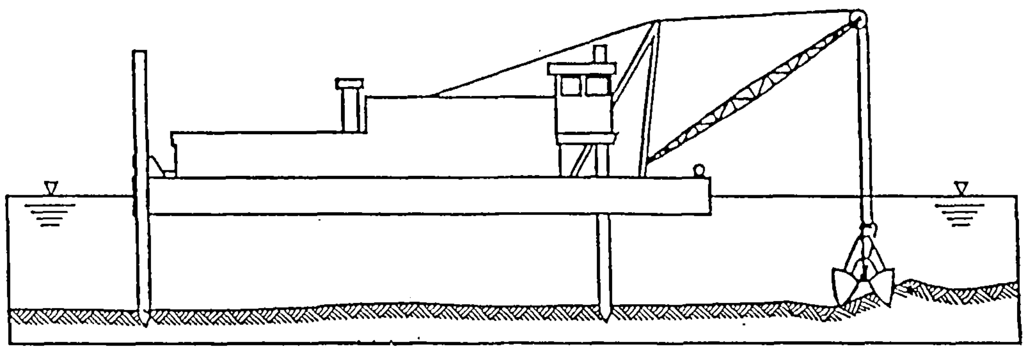
Environmental dredging pertains primarily to removal of contaminated sediments by dredging with equipment that will minimize turbidity and the re-suspension of contaminated sediments. Criteria for selecting the dredging equipment to accomplish this removal action were identified. Numerous dredge types, including mechanical, hydraulic, and special purpose dredges were listed, characterized, and evaluated using the selection criteria. Several options appear acceptable, including mechanical dredges, the closed bucket clamshell, cutterhead, and horizontal auger dredge. Other operational controls may be considered, as appropriate.

The first identified environmental dredging alternative involves the use of a closed bucket clamshell (Figure 15), a mechanical dredge, to remove some contaminated sediments. This dredge is capable of high production rates, is able to remove both sediments and debris, and can navigate some portions of Scuffletown Creek. The closed bucket or "environmental" bucket is very large and works best in deep water but would not have any advantage in shallow water. In the case of Scuffletown Creek, it would likely be too massive for the smaller dredges that would be able to get through the bridge to the shallow upstream reach. The closed bucket's primary advantage is minimizing the stripping of sediment from the bucket as it is lifted through the water column. While the use of the closed bucket may have significant contaminant release reduction in deeper waters, its effect may be negligible in shallow areas (such as upstream of the railroad bridge), and therefore its use in these areas may not be necessary. The use of a closed bucket clamshell, readily available within the Hampton Roads area, as well as consideration of operational controls, could help to reduce adverse environmental effects caused by this dredging in some areas of the creek.

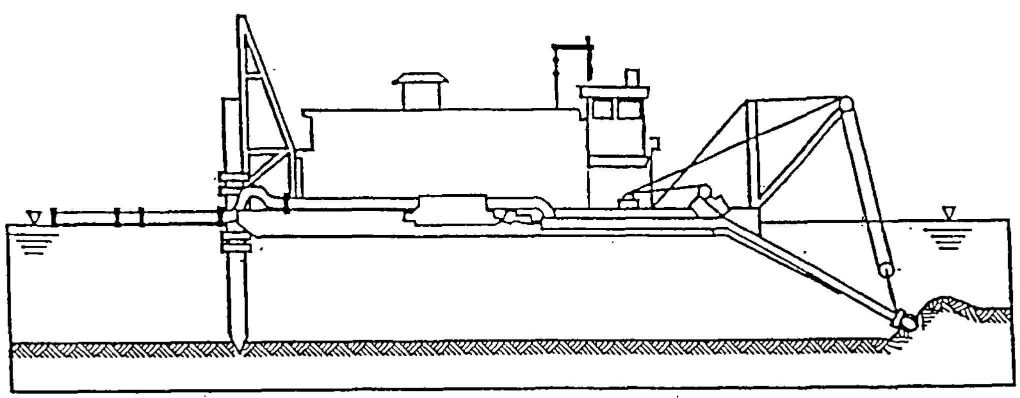
The second identified environmental dredging alternative involves the use of a cutterhead dredge (Figure 15), a hydraulic dredge, to excavate Scuffletown Creek sediments. This dredge is the most commonly used dredging plant and is versatile, capable of dredging clays, silts, sands, gravels, etc. The cutterhead dredge is also able to dredge while generating reduced amounts of turbidity. As with the closed bucket, other operational controls may be considered to reduce environmental effects.

The third identified dredging alternative involves the use of both mechanical and special purpose hydraulic dredging equipment. A closed bucket clamshell dredge could be used first to remove the majority of the contaminated sediments. As mentioned previously, the closed bucket works most effectively in deeper water. In order to excavate the last of the sediment intended for removal, without performing significant over-dredging, a special purpose dredge with greater vertical control than the closed bucket could complete the dredging operation. Two special purpose hydraulic dredges that have greater vertical control and generate relatively low amounts of turbidity include the horizontal auger dredge and the matchbox suction head dredge. Additionally, the cable arm bucket may provide greater vertical control.

Additionally, primary mechanisms of contaminant loss associated with remedial action activities were identified. Subsequently, an array of potential environmental protection measures were identified and evaluated for applicability to the project conditions and applicability to minimize primary mechanisms of contaminant losses. Applicable water quality controls, dredging operation controls, and/or environmental controls could be placed on the dredging operation to limit adverse impacts of this sediment removal action. Water quality controls may include placing limits on the amount of turbidity or concentrations of contaminants allowed in the water column outside the immediate dredging area. Dredge operation controls might include limiting



Clamshell dredge



Cutterhead pipeline dredge

FIGURE 15 . DREDGE TYPES

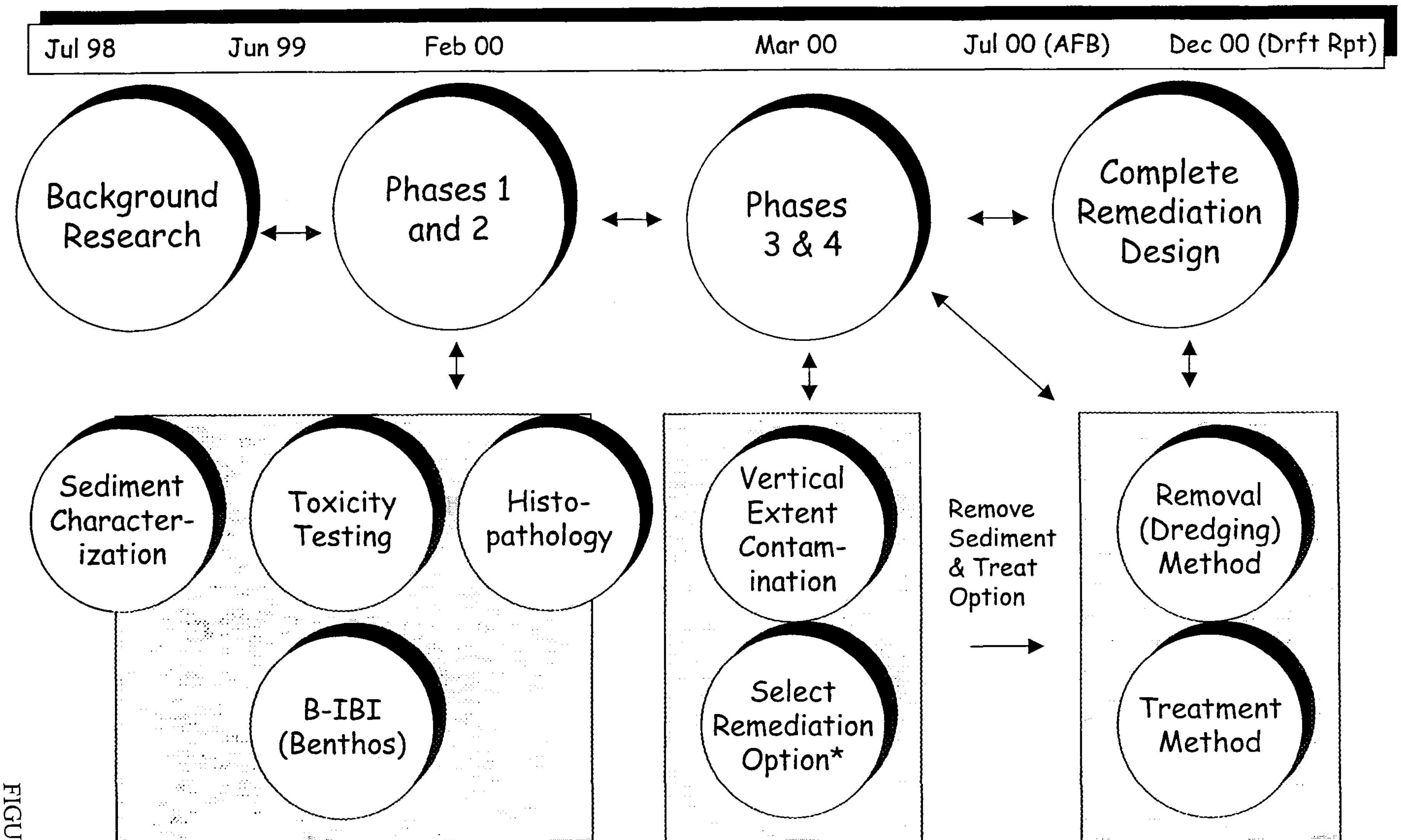
the bucket cycle time, prohibiting nighttime dredging operations, and not allowing buckets and scows to be overfilled. In addition, watertight scows and/or trucks should be required for transporting contaminated sediments. While it is virtually impossible to completely eliminate all environmental impacts of this dredging action, controls such as these can greatly reduce impacts.

For purposes of this report, various types of mechanical dredges were considered feasible given the logistical constraints of Scuffletown Creek. Various types of bucket dredges and excavators, including a closed clamshell bucket, are being considered as the most appropriate equipment for dredging in the creek.

Extent and Volume of Contamination. The general approach to evaluating the sediments in Scuffletown Creek is presented in Figure 16. This approach was developed by the Sediment Subcommittee and included looking at both chemical and biological indicators of sediment degradation. The approach is similar to the widely accepted "triad" approach, except that in addition to looking at sediment quality, toxicity, and benthic community health (the triad), this investigation also looked at a resident fish population (mummichog) for the incident of fish tumors/cancer.

In 1999, sediment core samples were collected from Scuffletown Creek from the mouth upstream to the Route 464 Bridge Project limit. The purpose of the bulk chemical analyses of 0 to 1 foot and 1 to 2 foot core sediment samples was to evaluate the distribution of various contaminants with respect to area and depth. Physical, particulate size, and bulk chemical, inorganic and organic, analyses of the samples were performed by EA Engineering, Science, and Technology, Inc. Additional data were collected in FY 2000 to fill in data gaps and more clearly define the vertical extent of contamination within defined "hot spot" areas in the creek. All the sampling sites are depicted on Figure 17.

Sediment Remediation Evaluations
Scuffletown Creek



*No Action; Contain sediment in place; Treat sediment in place; Remove (dredge) & contain; Remove (dredge) & treat

FIGURE 16

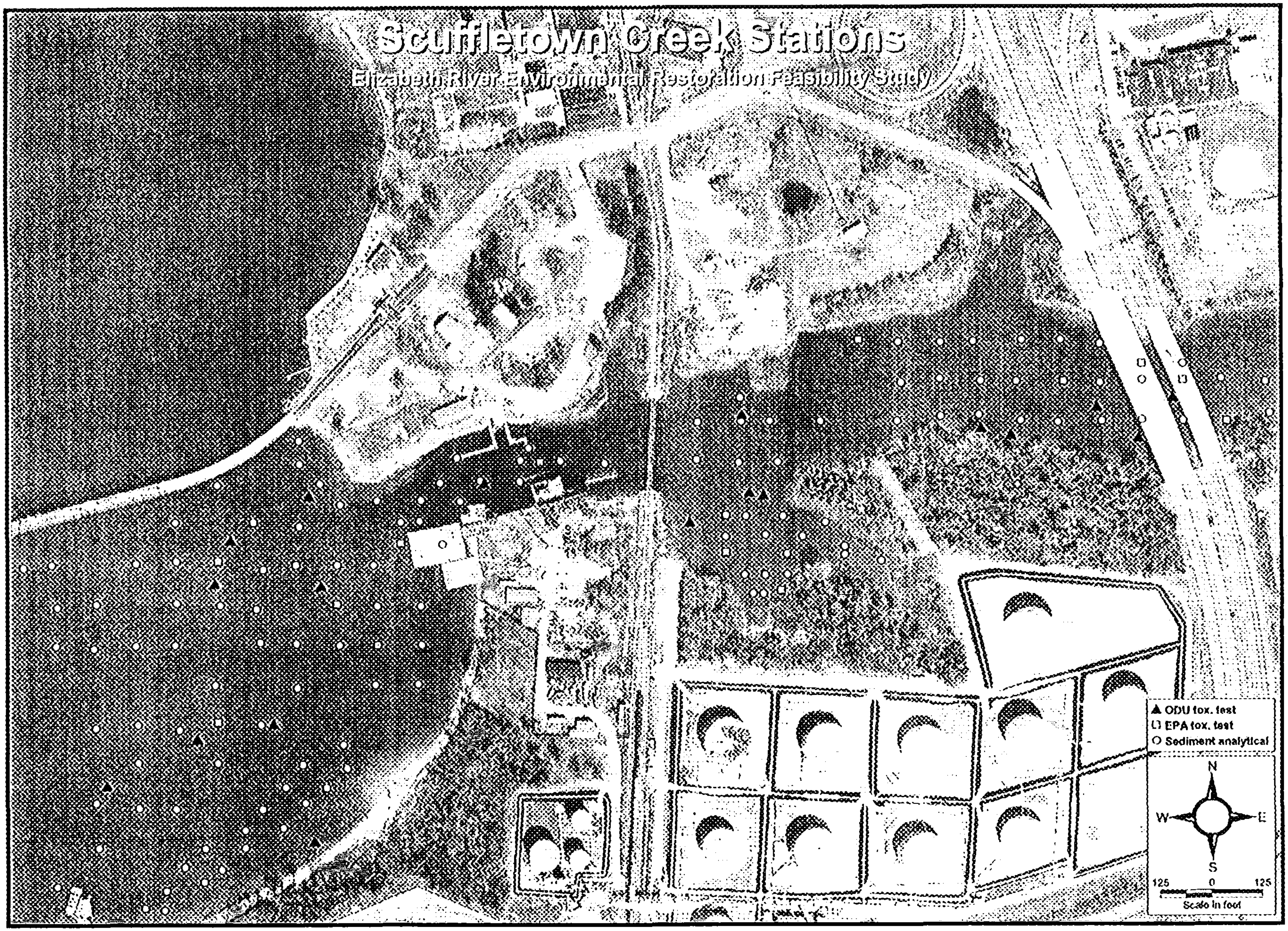

Scuffletown Creek Stations
Elizabeth River Environmental Restoration Feasibility Study
▲ ODU tox. test
□ EPA tox. test
○ Sediment analytical
N
W
E
S
125 0 125
Scale in feet

FIGURE 17

Particle size analysis of the Scuffletown Creek sediment samples indicated that the sediments are composed primarily of silts, clays, and fine sands. Inorganic and organic analyses of the sediment samples indicated that most core sediments are generally considered contaminated by established sediment quality criteria.

A Sediment Subcommittee was formed to address the issue of sediment contamination in the Elizabeth River. Representatives included individuals from the Virginia Department of Environmental Quality (DEQ), U.S. Fish and Wildlife Service (USFWS), VIMS, ODU, Elizabeth River Project (ERP), and COE personnel. Since no criteria for sediment contamination, treatment and removal levels exists, the Subcommittee was faced with developing a criteria of its own that would apply to the proposed sediment restoration at Scuffletown Creek.

During the Phase I investigations, an extensive chemical survey was conducted in Scuffletown Creek to determine the magnitude and extent of sediment contamination. One hundred forty-eight stations were sampled in the creek. Sediment contaminant concentrations in these samples were compared to the sediment quality benchmarks. This information was plotted on a map of the creek to visualize the distribution of contaminants. These maps were useful in identifying contaminant "hot spots"; however, because the sediments were contaminated with a mixture of chemicals, including metals and PAHs, the approach did not allow the derivation of clean-up values.

There are several benchmarks that have been used to evaluate sediment quality. These include: empirical approaches such as Long and Morgan's (1990) Effects Range-Low and Effects Range-Median (ERL/ERM) and the threshold effects level/probable effects level (TEL/PEL) developed by Smith et al., (1996) that rely on correlations between sediment concentrations and biological effects; EPA's sediment quality guidelines that use a theoretical approach to estimate bioavailability of sediment contaminants; and more recently the development of consensus-based guidelines that integrate the empirical and theoretical approaches. At present, the number of chemicals for which EPA or consensus-based guidelines exist is limited. Therefore, sediment contaminant data in Scuffletown Creek were evaluated by comparing ambient concentrations to either PEL or ERM values (whichever was lower). These benchmarks represent concentrations above which biological effects are frequently observed.

In order to summarize and integrate this information, Sediment Quotient Values (SQVs) were calculated by dividing the concentration of a contaminant at each site by its sediment quality benchmark (i.e., ERM or PEL), summing these values and then taking the average. The SQV reflects both the magnitude and frequency by which benchmarks are exceeded and provide a way to integrate the chemical data on one scale. In addition, several researchers have shown a good correlation between SQVs and sediment toxicity or benthic community impairment (McGee et al., 1999, Canfield et al., 1996, Fairey et al., 1999. Data from Baltimore Harbor presented in McGee et al., 1999, indicated that ERM SQVs of 0.4 and 0.8 delineated ranges where, at the low end, there was no observed sediment toxicity and, at the high end and above, there was always acute toxicity. Fairey et al., 1999 reported a similar relationship between SQVs and benthic community health in marine and estuarine sediments from California. Since these numbers seemed robust, the Sediment Subcommittee decided that 0.4, 0.6 and 0.8 would be the SQVs that would be contoured to identify hotspots in Scuffletown Creek, with the contours representing different clean-up scenarios.

The SQV method generated "hot spots" that were very similar to those generated by looking at the ERM and PEL values separately, which added more confidence to the validity of the assessment of "hot spot" locations.

The Norfolk District conducted a three-dimensional analysis (Groundwater Modeling System, or GMS) to determine the extent and volume of contaminated sediments using the results of the sediment sampling events. Figures 18, 19, and 20 depict these SQV contours of 0.4, 0.6, and 0.8.

In the Phase II investigation, 12 station locations were selected to reside within "hot spots" that were identified in the Phase I investigation in Scuffletown creek through the ERM SQV method. The 12 samples were taken using vibracore equipment, and each one-foot increment was homogenized for analysis in the lab. The results of the bulk chemical analysis on the 12 stations were then converted into ERM SQV's and the SQV breakpoints as previously used to contour "hot spots" in the Phase I investigation. This information was then used to contour ERM SQV "hot spots" at one-foot increments between 2 and 6 feet. In addition to bulk chemical data analysis, the samples were also analyzed by means of the Toxicity Characteristic Leachate Procedure (TCLP) to determine suitability for direct disposal in a regulated landfill.

The results of the GMS analysis for the Phase II investigation at Scuffletown Creek indicated that there are considerable levels of contamination at the first two depth intervals (2-3 feet and 3-4 feet). However, the data does show that after a certain depth (4-5 feet), contamination drops off considerably until the material does not exceed the ERM SQV clean-up level of 0.6. This provided assurance that removal of overlying 0.6 ERM SQV sediments would expose clean bottom sediments at a depth of approximately 5 feet.

Biological indicators of the ecological condition of Scuffletown Creek were also evaluated and included toxicity tests (surface and subsurface sediments); Benthic Index of Biotic Intergrity (B-IBI) – a measure of benthic community health; and fish (mummichog) histopathology. The results of these tests are presented in Table 11. These biological indices, in combination with elevated the levels of sediment contaminants as compared to recognized sediment quality criteria, provide a weight of evidence which confirms the degraded condition of Scuffletown Creek.

Table 11. EVALUATION OF SEDIMENTS IN SCUFFLETOWN CREEK

Measure	Results
B-IBI (Benthic Index of Biotic Integrity)	• 76% Degraded bottom • No deep dwelling organisms • 4% pollution sensitive species • 67% Pollution-indicative species
Toxicity – Surface Sediments (1-2 cm)	Low Toxicity (>80% survival)
Toxicity – Subsurface Sediments	High Toxicity (0-40% survival)
(Fish) Histopathology	• Borderline Problem • AHF* 5-20% • Neoplasms 0%
Sediment Quality	• Organics up to 9X the ERM** • Metals up to 6X the ERM

*AHF: Altered Hepatocellular foci are small precancerous liver lesions
**NOAA Effects Range Median (ERM) = Based on NOAA guidelines - used to delineate the potential biological impact of a variety of contaminants. Chemical concentrations at or above the ERM represent a probable effects range within which effects would frequently occur.

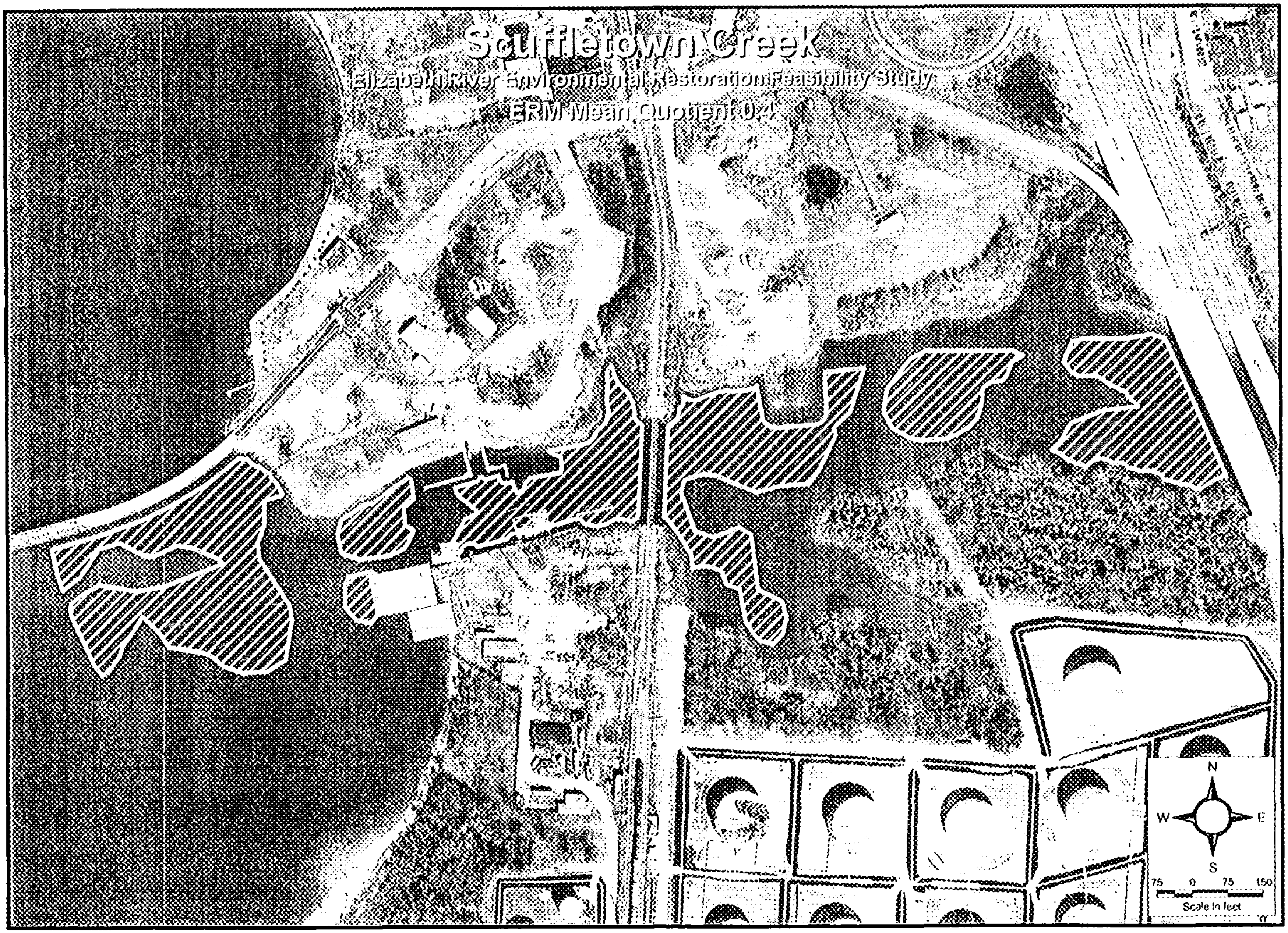

Scuffletown Creek
Elizabeth River Environmental Restoration Feasibility Study
ERM Mean Quotient 0.4
N
W
E
S
75 0 75 150
Scale in feet

FIGURE 18

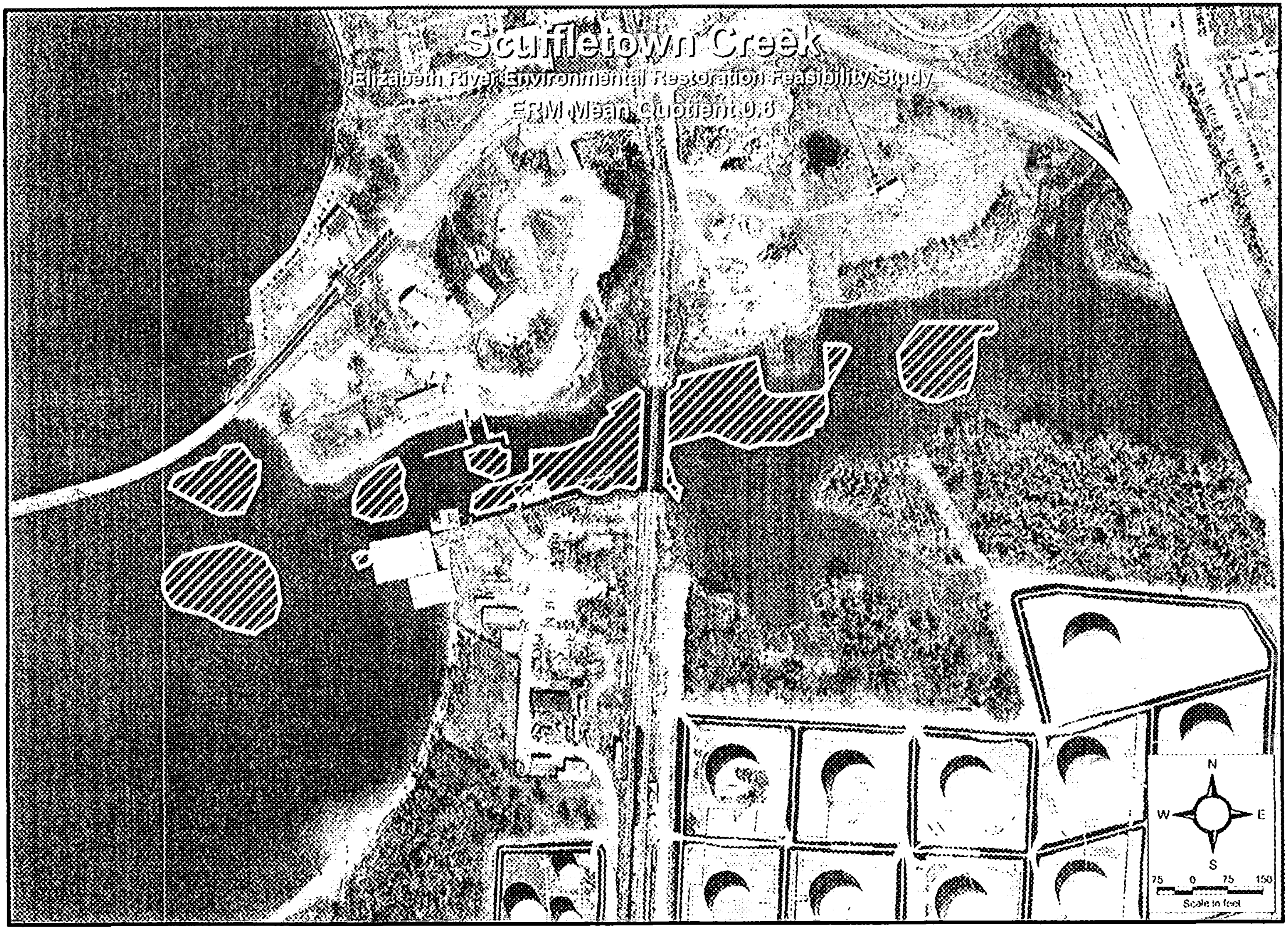

Scuffletown Creek
Elizabeth River Environmental Restoration Feasibility Study
ERM Mean Quotient 0.8
N
W
E
S
75 0 75 150
Scale in feet

FIGURE 19

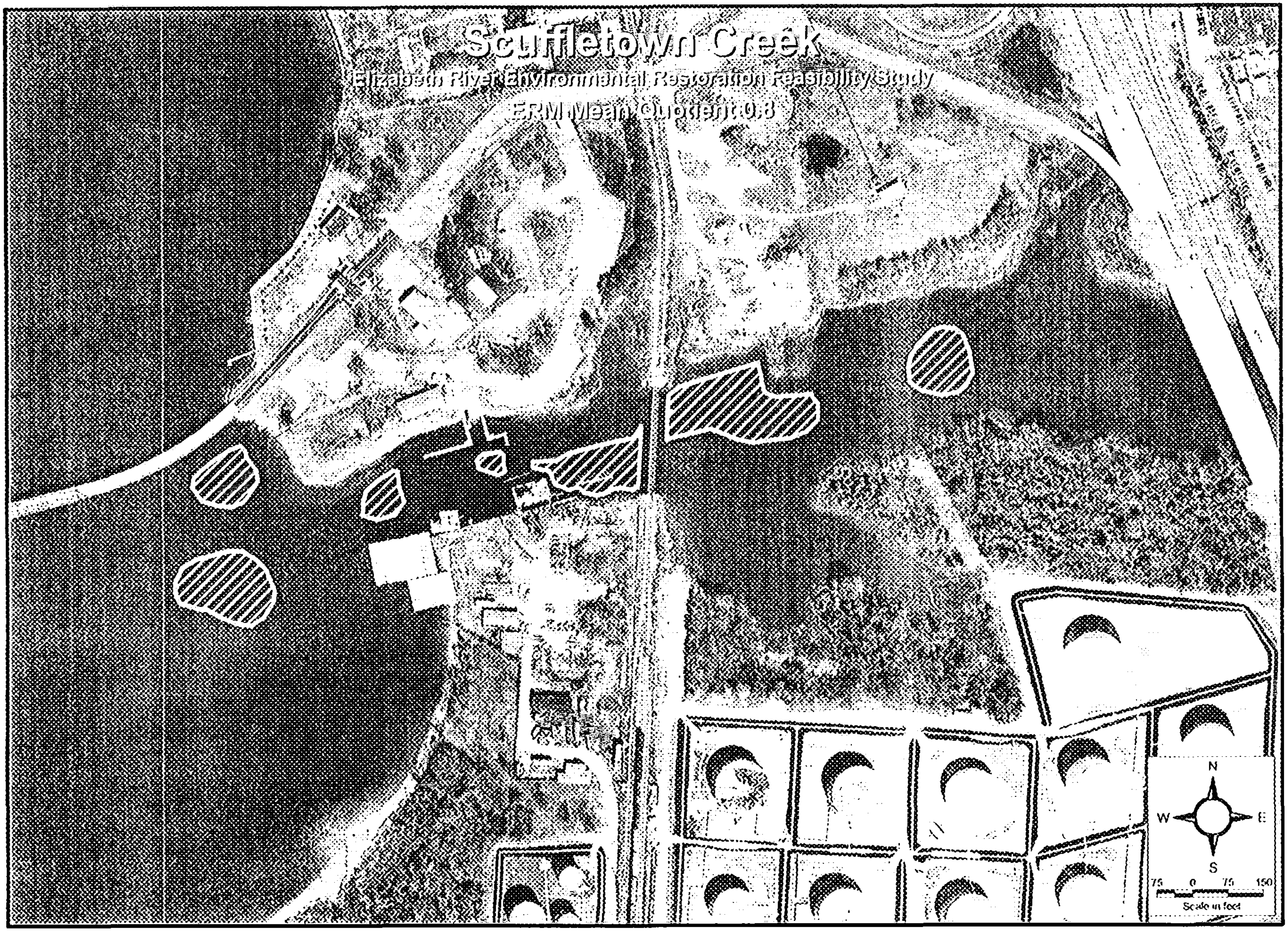

Scuffletown Creek
Elizabeth River Environmental Restoration Feasibility Study
ERM Mean Quotient 0.8
N
W
E
S
75 0 75 150
Scale in feet

FIGURE 20

Sediment Evaluations at Other Sites. As mentioned previously, three other sediment sites were evaluated during this study. These were Scott's Creek, the former Eppinger and Russell wood treatment facility on the Southern Branch, and in the vicinity of the Campostella Bridge on the Eastern Branch (see Figure 14). Both bulk chemical analysis and sediment toxicity were evaluated. The numerical results of these analyses are presented in Appendix E, Environmental Technical Reports. Based upon these preliminary investigations, the highest levels of contamination are found at Eppinger and Russell, then Scott's Creek, and finally at the Campostella Bridge site. This information should be evaluated carefully for future, follow-on feasibility investigations as presented in Figure 13.

Capping of Contaminated Sediments. An estimate was prepared for the cost of installing a two-foot clean sand cap over the contaminated areas dredged for each of the three ERM SQV levels of clean-up. The estimate included the cost of the sand, transporting it to the site, and hydraulically placing the sand over all of the dredged contaminated areas. The approximate costs were as follows: 0.4 SQV area coverage: $1,260,000; 0.6 SQV area coverage: $570,000; 0.8 SQV area coverage: $365,000.

While the cost for capping is substantially less than dredging and removal, capping at Scuffletown Creek is not a practical alternative due to shallow depths. Scuffletown Creek is a relatively shallow tidal creek with an average depth of about 2-3 feet, with many areas less than this depth. Capping may be a problem in areas where the cap would convert the creek's shallow water and mud flats into upland.

There are also additional difficulties with capping as a solution: 1) capping may exclude future consideration of providing recreational navigation access: capping the contaminated sediments may preclude any possibility of dredging the site in the future as dredging could release contaminated sediments; and 2) capping could disrupt the hydrology of the aquatic environment and potentially create non-contiguous basins with the potential for anoxic conditions. It should also be noted that any capping performed in the creek, which would limit the existing flow, would have a high potential of being scoured away.

For these reasons, capping within Scuffletown Creek was eliminated from further consideration as a feasible restoration alternative.

Dredging Scenarios and Sediment Volume Estimates. As explained previously, three primary dredging plans (clean-up mean ERM SQV levels of 0.4, 0.6, and 0.8) were formulated to address removal of contaminated sediments. These dredging scenarios were evaluated in order to determine the amount of sediment to be removed consistent with project goals.

The following methodology was used:

- Develop GMS contours for SQV's of 0.4, 0.6, and 0.8 (both area and depth)
- Determine sediment volume to be removed for each scenario
- Determine buffer areas adjacent to railroad bridge, bulkheads, and shoreline features
- Determine dredging equipment and cost
- Determine pretreatment, treatment, and transport costs
- Determine final placement costs
- Assess all three clean-up scenarios, considering cost and environmental benefits

The dredging volumes calculated for each level of clean-up using this approach are presented in the following table.

Table 12. DREDGING VOLUMES FOR EACH LEVEL OF CLEAN-UP

Dredging Volumes [1]	
Clean-up Level (SQV)	Depth: 0-6 Feet [2]
0.4	129,680
0.6	60,270
0.8	38,800

[1] All quantities are in cubic yards.
[2] Quantities assume dredging both above and below the RR bridge to a depth of 6 feet.

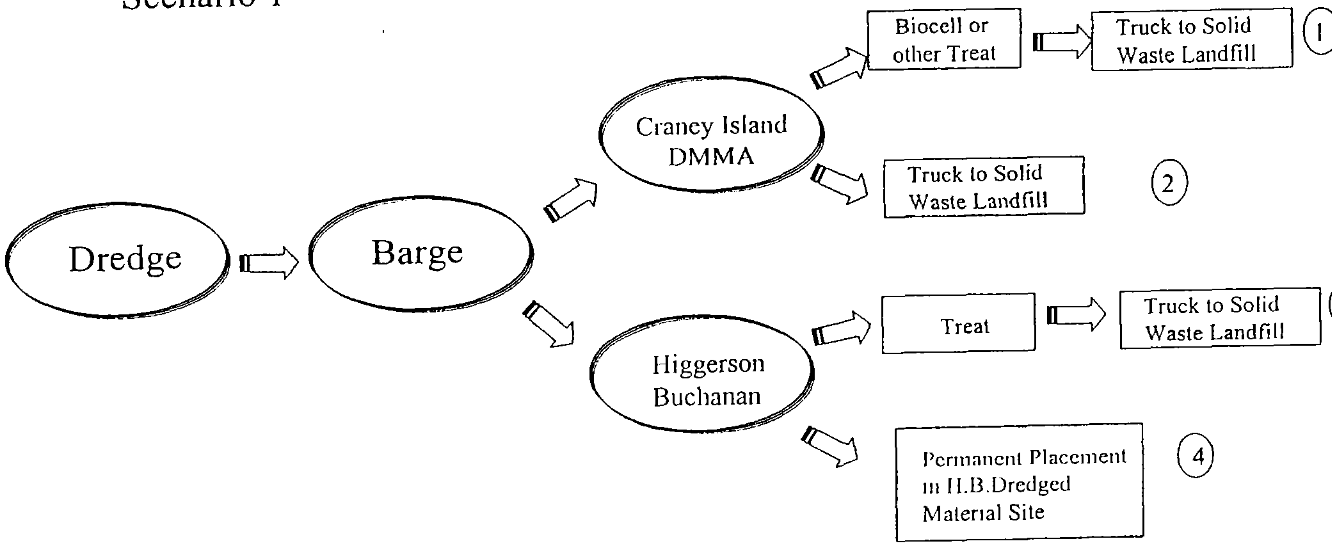
In addition to environmental dredging, remediating the contaminated sediments in Scuffletown Creek will also involve transport, possible treatment, and final disposal. These have all been evaluated as part of the clean-up "train" or process. The different trains are displayed in Figure 21. Candidate placement sites are displayed in Figure 22. The trains are grouped in sets of two because not all of the material will need remediation. Trains one, three, six, and seven represent a system of removing, treating, and disposing contaminated material. These trains contain an additional step, which represents the treatment process (stabilization or bioremediation). The remaining trains (two, four, five, and eight) lack the remediation element because they describe a system of removing and disposal of material that does not need treatment. These trains outline a method of removing the material and transporting it for direct placement in the final placement location. The two dredged material management sites under consideration are Craney Island Dredged Material Management Area (CIDMMA) and the Higgerson Buchanan Site, located on the Southern Branch and formerly used for dredged material placement in the early 1980's in connection with the Southern Branch deepening to 35 feet. By law, dredged material cannot be placed permanently into CIDMMA unless it is navigation related. The environmental dredging proposed at Scufffletown Creek would not qualify as "navigation related" dredging since it is strictly for environmental restoration, not navigation. CIDMMA could, however, be used as a temporary placement site or staging area prior to treatment or final deposition at another site. At this time it has not been identified which pair of trains will be used to transport, treat and dispose the material dredged from Scuffletown Creek, are all feasible.

Possible Solutions - Wetland Restoration

Priest (1999) suggested that "...studies of historical (wetland) losses provide a framework for a comprehensive management program within the Elizabeth River system by:

1. Providing the basis necessary to direct focus of restoration efforts to those areas that have experienced the greatest losses and would stand to benefit most from restoration.
2. Providing locations of former wetlands having the greatest potential to be successfully reestablished through restoration efforts. These areas, which once supported various wetland communities, have the potential advantage of continuing a hydrological link with the watershed that could make restoration efforts more effective and efficient at restoring lost wetland functions and values.
3. Focusing restoration efforts in former wetland areas, restoration programs avoid the public perception of converting established habitats, such as riparian forest buffers into wetlands. Because many converted wetlands never fully recover ecologically and remain disturbed habitats of relatively low ecological value, the loss of existing natural function can be minimized.
4. (Providing opportunity) to select former sites of appropriate landscape position, significant size, and level of disturbance, the (information) supports economy of scale and reestablishment of natural functions that make wetlands restoration a very effective tool for habitat and water quality improvement within the Elizabeth River watershed".

Scuffletown Creek
(Proposed) Treatment Train
Scenario 1



Scuffletown Creek
(Proposed) Treatment Train
Scenario 2

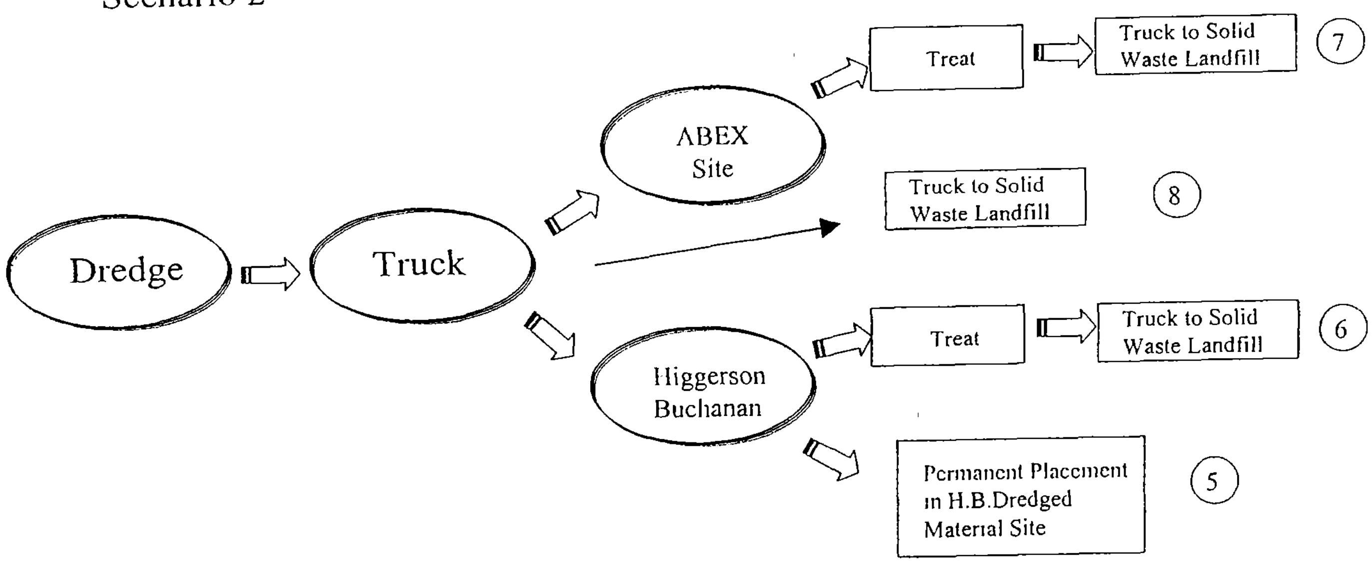


FIGURE 21. ALTERNATIVE SEDIMENT CLEAN UP TRAINS

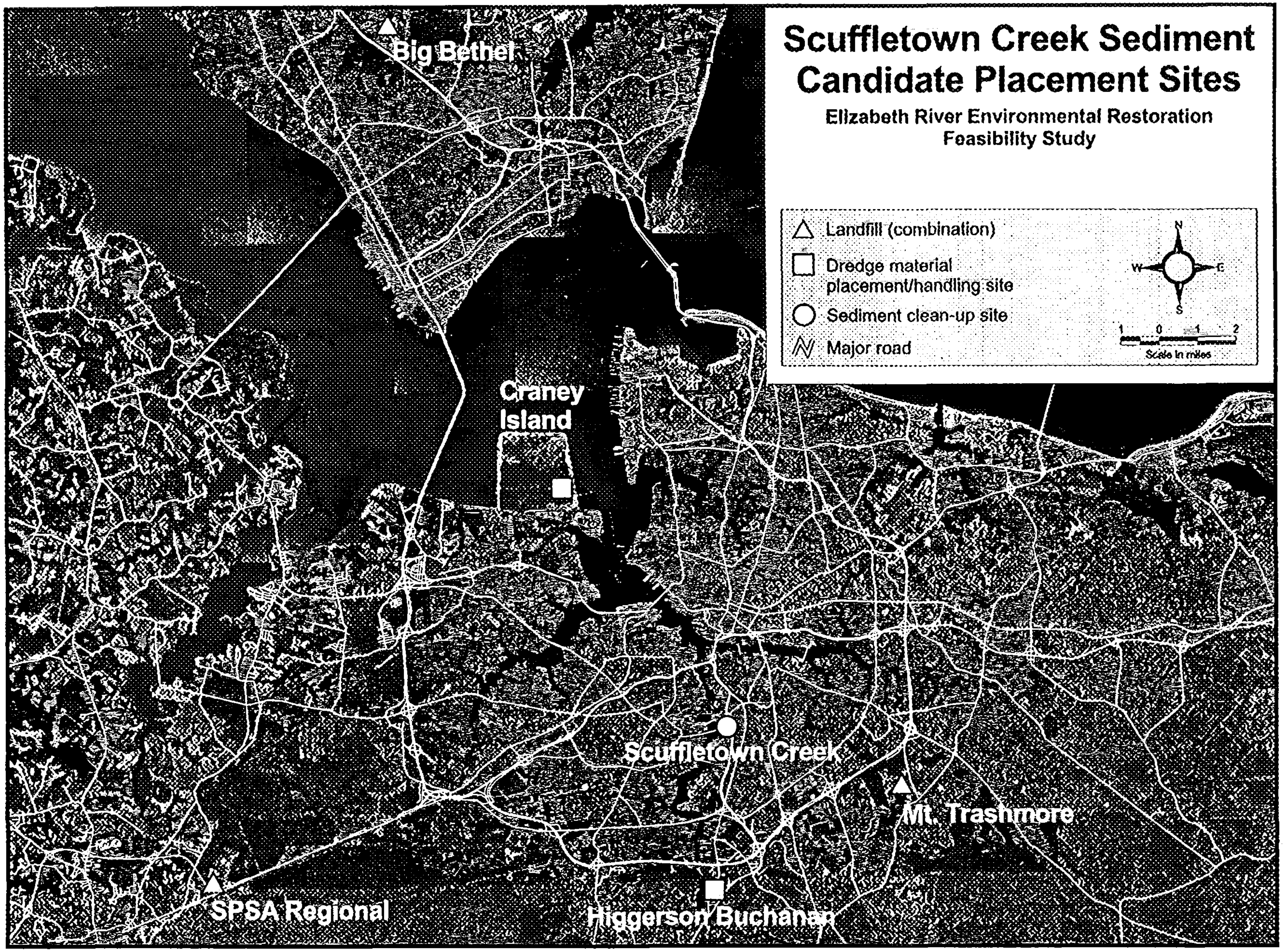

Scuffletown Creek Sediment
Candidate Placement Sites
Elizabeth River Environmental Restoration
Feasibility Study
Landfill (combination)
Dredge material
placement/handling site
Sediment clean-up site
Major road
N
W
E
S
1
0
1
2
Scale in miles
Big Bethel
Craney
Island
Scuffletown Creek
Mt. Trashmore
SPSA Regional
Higgerson Buchanan

FIGURE 22

Most of the wetland sites selected for restoration in this investigation were wetlands at some time in the historical past. During the period from 1944 to 1977 approximately 50 percent of tidal wetlands were lost in the Elizabeth River Basin (Priest, 1999). Many of these wetland areas were filled to create uplands and provide dry land for industrial, military, and residential development. Some of the historical maps obtained for sites under investigation in this study show wetland filling in progress. Three of the proposed wetland restoration sites (Crawford Bay, ODU Drainage Canal, and NW Jordan Bridge) are currently shallow water or intertidal open water areas adjacent to storm water canals, drainage features, or stormwater outfall structures.

In a highly urbanized Elizabeth River watershed, with industrial, commercial, and residential development prominent along the waterfront, the opportunities for wetland restoration are limited. Sites were selected for potential implementation that are contiguous to existing wetlands and had themselves functioned as wetlands in the past. This connectivity aspect enhances the value of the existing wetlands, and offers greater likelihood that the new wetlands sites will succeed.

Two basic solutions are proposed for wetland restoration/creation: excavation and filling. Excavation and regrading is required at those sites where (historical) wetlands have been filled. Once the fill material is removed, the site is regraded and the proper elevations required to sustain tidal emergent wetlands are established. Filling to build a "bench" or substrate elevation for wetland plants is required for creation of emergent wetlands in those areas which are now tidal or subtidal. Table 13 depicts the proposed solution at each of the candidate sites:

Table 13. WETLAND SITES AND PROPOSED RESTORATION SOLUTIONS

Location	Current Condition	Proposed Solution
Scuffletown Creek, Chesapeake	Filled (former) Wetland	Excavate, grade, plant
W. Branch Park, Chesapeake	High Marsh/Upland (Common Reed)	Herbicide
Somme Avenue, Norfolk	Filled (former) Wetland	Excavate, grade, plant
Grandy Village, Norfolk	Filled (former) Wetland	Excavate, grade, plant
ODU Drainage Canal, Norfolk	Intertidal Shallow Water Stormwater	Fill, grade, plant
Sugar Hill, Portsmouth	Filled (former) Wetland	Excavate, grade, plant
NW Jordan Bridge, Portsmouth	Intertidal Shallow Water Stormwater	Fill, grade, plant
Crawford Bay, Portsmouth	Intertidal Shallow Water Stormwater	Fill, grade, plant
Portsmouth City Park, Portsmouth	Filled (former) Wetland	Excavate, grade, plant
Lancelot Drive, Virginia Beach	Filled (former) Wetland	Excavate, grade, plant
Carolanne Farms, Virginia Beach	Upland	Excavate, grade, plant
Woodstock Park, Virginia Beach	Borrow Pit	Fill, grade, plant

Environmental Dredging - Risk of Recontamination. For hundreds of years, the Elizabeth River system has received and currently continues to receive contaminant input (i.e., toxins) from upland sources. Toxic input to the Elizabeth River includes pollutant loads from permitted facilities (point sources) and from stormwater runoff (non-point sources). Upland sources of toxins include existing or abandoned industrial sites, contaminated groundwater, leaking underground storage tanks (LUST), and oil spills. Effluent (both point and non-point) discharged to the river is dispersed through tidal flushing and advection from freshwater inputs. Freshwater input is minimal to the Elizabeth River watershed except as a result of stormwater inflow. Therefore, tidal flushing is primarily responsible for the dispersion of pollutants. Tidal velocities are highest along the main stem and near the mouths of the individual branches. Likewise, tidal velocities are minimal near the uppermost reaches of each tributary (Cerco and Kuo, 1981).

In light of this information, a pertinent question that should be asked is: Given that contaminants are continuing to enter the river, will sediment remediation at specific sites provide long-term and sustainable reduction of contaminant levels? The response to this question is, yes, sediment remediation at specific sites will provide long-term and sustainable reduction of contaminant levels. Why?

1. Some of the most contaminated upland sites are now being remediated under both mandatory and voluntary actions (i.e., Atlantic Wood, Navy Shipyard, etc.). Considering private land ownership issues, and the identification of responsible parties, it may be decades before all of the most seriously contaminated upland sources are addressed. A combination of river sediment clean-up and upland soils/groundwater remediation will provide a synergistic effect to clean-up the river. Both are needed to realize restoration of the river bottom. Currently, only the upland has ongoing remediation efforts.

2. Given that industrial activity was largely unregulated prior to 1950 which is no longer the case, and that many polluting industries, especially creosoting facilities, are no longer in operation, sediments are not likely to be re-contaminated at the same gross levels as they were in the historical past.

3. The proposed sediment remediation at Scuffletown Creek would target highly contaminated sediments (i.e., "hot spots" related to historical activities), with more marginally contaminated areas to be addressed after upland sources are cleaned up.

4. The target site for sediment remediation is Scuffletown Creek. Sediment remediation under Superfund may be an operable unit (OU) at Atlantic Wood and the Naval shipyard, both directly across the river.

5. The existing condition of the near surface sediments is a good indicator of what could be expected as a post-remediation condition in Scuffletown Creek. Near-surface sediments are the most likely to be transported by tidal currents and other physical processes into areas that have been remediated. Also, near surface sediments would be the most likely to contain contaminants from stormwater run-off and other more recent events causing deposition of sediment. Our studies in Scuffletown Creek, Scotts Creek, and the Eastern Branch (Campostella) (Winfield, 2000) indicate that these surface sediments are typically non-toxic to benthic organisms. In laboratory tests using these sediments, mean survival was greater than 90%. Therefore, it is anticipated that after clean-up of Scuffletown, newly deposited sediments would <u>not</u> be toxic to benthic organisms, and subsurface sediments would have substantially reduced contaminate levels related to the Section 312 clean-up efforts.

6. Although recontamination of the river is occurring, the river is <u>not</u> being recontaminated to the same historical levels. If that were true, the entire river bottom would be one "hot spot." Sediment investigations indicate that there are isolated areas in the river bottom, which form a mosaic of contamination, not a homogeneous distribution

of gross contamination. This is due in large part to improved watershed usage and regulatory measures now in place to ensure that the discharge of contamination that occurred during the last 100 to 150 years do not continue to take place.

Table 14 explains the commitment of the non-Federal sponsors to cleaning up the river; improvements already made in water quality; and the commitments to regulating future waterfront property use and activities. Also, significant water quality improvements have already been made as a result of improved industrial, and storm water management practices. For example, 10-year trends from data collected by numerous agencies for indicators such as nutrients and dissolved oxygen showed the Elizabeth River with some of the most improving trends for these specific water quality indicators of any river basin on the Chesapeake Bay.

The Virginia Department of Environmental Quality (DEQ) implemented a long term monitoring program to follow/track the fate of contaminants. This kind of information, when available, should help the non-Federal sponsors develop management strategies that will further reduce the risk of recontamination.

There is no way to completely eliminate the risk of site recontamination. The first sediment restoration in the river poses some risk. As future clean-up efforts in the river lead to progressively larger spatial areas of "hot spot" clean-up, risk of re-contamination will be significantly reduced.

Table 14. COMPLEMENTARY ACTIONS OF OTHERS
IN THE ELIZABETH RIVER BASIN

Action	Sponsors/Proponents	Accomplishments
Derelict Vessel Inventory and Removal	• Commonwealth of Virginia, Virginia Marine Resources Commission • Cities • Elizabeth River Project	• 145 abandoned vessels inventoried • 28% (40) removed to date • $100,000 funded annually
Monitoring of River Trends	• Commonwealth of Virginia, Dept. of Environmental Quality • Elizabeth River Project	Intensive monitoring program implemented in 1998 tracks trends in water quality, sediment quality, and living resources (approx. $450,000 funded annually).
Leadership of Community Wide Implementation of Watershed Action Plan	• Elizabeth River Project • Cities in Watershed • Businesses/Industries • Government • Citizens	• Fosters partnership of business, government and citizen interests to implement Watershed Action Plan adopted by state in 1996 • River Star Program (over 60 businesses and industries have committed to pollution prevention and/or habitat enhancement) • Restoration results since 1996 include 32 acres of wetlands and wildlife habitat restored; 16,000 oysters grown; 25 River Star habitat projects completed; 48,143 native plants installed at restoration sites
Urban Stormwater Solutions Workshop and Charrette	Elizabeth River Project and participants	Participants identified storm water problems and worked on solutions, including financing.
Wetland Restoration Projects	• Elizabeth River Project • City of Norfolk • City of Chesapeake	Completed: Birdsong Wetland – Norfolk Pescara Creek – Norfolk Design Underway: Southgate Plaza – Chesapeake – will treat urban stormwater from a 250-acre drainage area

Table 14.cont'd. COMPLEMENTARY ACTIONS OF OTHERS IN THE ELIZABETH RIVER BASIN

Action	Sponsors/Proponents	Accomplishments
Oyster Reef Restoration	• Chesapeake Bay Program • VMRC • Rotary Club	Since 1999, 20 acres of oyster reefs and grounds have been restored throughout the river where no productive reefs have existed for decades.
Water Quality Improvements	• River Stars • DEQ, point source regulation • Industry compliance	• By 2000, 60 organizations, including some of Virginia's largest corporations participating in programs to reduce polluted runoff: number one source of new pollution in the Elizabeth. • Dissolved oxygen shows improving trends with very few values below the standard since 1996. • Nutrient levels generally decreasing. • Dissolved metals significantly lower than historical data suggested.
National Priorities List (NPL) Cleanup Actions under "Superfund"	• Atlantic Wood Industries, Inc. • Norfolk Naval Ship Yard • EPA • DEQ	• Response actions include Remedial Investigations and cleanup activities both on land and in the S. Branch of the Elizabeth R.

VIII. DEVELOPING A PLAN

DESIGN CRITERIA

Wetland Restoration

The restoration alternatives developed during the study were based on the following general project objectives:

1. Natural marsh/wetland locations and elevations should be used as a benchmark for developing marsh restoration profiles.
2. Projects will be designed and developed to maximize functional benefit values.
3. Projects will be designed and developed to minimize wetland and other adverse environmental impacts.
4. Projects will be designed and developed to minimize project costs for each alternative.

Wetland Design Criteria

Wetland design was developed in accordance with the following reference documents:

1. WES, Wetlands Research Program Technical Report WRP-RE-19 (February 1998), *Engineering Specification Guidelines for Wetland Plant Establishment and Subgrade Preparation.* (K. P. Dunne, A. M. Rodrigo, and E. Samanns)
2. Dept. of the Army, US Army Corps of Engineers, Engineering Manual (EM) 1110-2-5026. Beneficial Uses of Dredged Material (1986)
3. Wetlands Engineering Handbook, ERDC/EL TR-WRP-RE-21, http://www.wes.army.mil/el/wetlands/pdfs/wrpre

The general approach for wetland habitat selection, design, and development is depicted in Figure 23. More detailed information on wetland development and design is presented in Engineering and Cost Data, Appendix A, Attachment B.

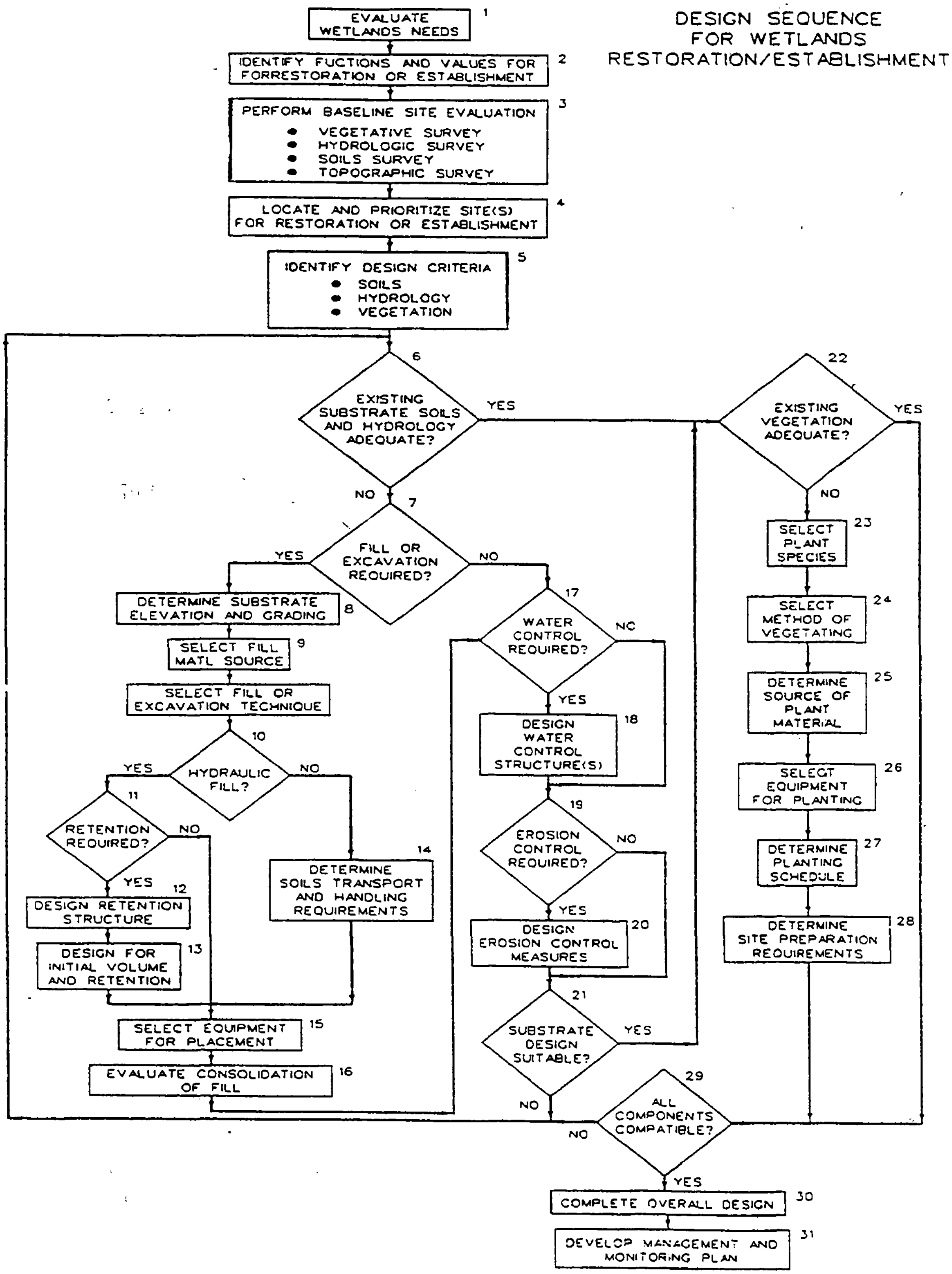


FIGURE 23 . FLOWCHART ILLUSTRATING DESIGN SEQUENCE FOR WETLANDS RESTORATION PROJECTS

Sediment Restoration Design Criteria

Sediment clean-up was developed in accordance with the following reference documents:

1. EPA handbook entitled "Selecting Remediation Techniques for Contaminated Sediment" (June 1993);
2. COE/EPA reports related to WRDA 1992, Section 405(a) and WRDA 1996, Section 226 (Sediment Decontamination Technology Studies);
3. Corps of Engineers Implementation Guidance for Section 312 dated 25 April 2001, and Section 312 of WRDA 1990, as amended by Section 205 WRDA 1996 and Section 224 of WRDA 1999.

COE, WES, and other nationally recognized publications have served as planning and design guides.

ECONOMIC ASSUMPTIONS

Introduction

This section summarizes the procedures and assumptions used in developing costs for both the wetland and sediment sites. All prices throughout the analysis are in FY 2001 dollars, with 6-3/8 percent interest rate used in present value and annualization calculations. The project planning period for both portions of the project is 50 years, with construction beginning in 2003. As the project benefits are in current values, no inflation factor was added to the cost estimates, even though construction is not anticipated to begin for three years. Most of the damage targeted by this project occurred prior to current environmental regulations, so further contamination or destruction is unlikely. For the wetland sites, the decision to use a 50-year period of analysis was also based upon the knowledge of local conditions. The area is stagnant without much potential for degradation of the proposed wetlands; thus it is likely that the benefits derived from the project will not diminish with time. The report section on environmental benefits contains a more detailed explanation of the local conditions that influenced this decision.

Wetland Sites – Cost Assumptions

In July 2000, Virginia Geotechnical Services (VGS) provided construction costs for all wetland sites. The construction costs provided by VGS were revised and adjusted by the Norfolk District Cost Engineering Section to reflect costs of similar COE projects. The construction costs for all sites consist of three categories- site preparation, earthwork, and landscaping. Site preparation costs include mobilization, brush clearing, timber matting, stone, erosion control, and demobilization. The earthwork category includes all costs for either excavation or filling, as applicable for each site. As examples, costs for an excavation site would include the actual excavation, hauling and disposing of the material, while costs for a filled site the costs include acquiring the material, transporting it to the wetland site, and depositing it. The final category of costs, landscaping, includes all costs associated with constructing the wetland, such as topsoil, plants, and planting. Construction costs included in this analysis have been developed using TRACES estimates; they represent total or fixed fee cost estimates. They are a conceptual representation of the approximate order-of-magnitude costs associated with the design concepts described. These estimates are not based upon solicitations from qualified contractors, but rather are based upon representative unit costs for similar construction projects in the Tidewater Virginia area. A 25 percent contingency was added to all construction estimates in order to capture any unforeseen complications.

In addition to the construction costs, costs associated with real estate acquisition have also been considered and included in the analysis. The local sponsors own most of the identified wetland sites, so the costs consist primarily of the assessed values. The estimates are based upon the following assumptions:

1. The property rights would be used for wetlands creation or enhancement;
2. Estimated values apply only to land above the mean high water line;
3. Navigational Servitude will be sufficient for any work below m.h.w.;
4. No improvements would be acquired for the project; and
5. Local sponsors will be entitled to credit for the real estate acquired.

Real Estate assumptions and estimates are defined in more detail in the Real Estate Supplement, Appendix B. The construction contractor will be responsible for a 90 percent survival rate on all plantings throughout the first three years; maintenance costs included in the analysis reflect this responsibility. Average annual maintenance costs, estimated at $1,150, are representative costs associated with limited debris removal and spot control of invasive plant species throughout the 50-year project life. Extensive maintenance costs were assumed unnecessary because the wetland sites are designed to be self-supporting and sustaining.

Potential conflicts with existing utility lines, including telephone, gas, electric, sewer, storm, cable, and water were considered. Utility companies were contacted about the proposed sediment restoration and/or each of the proposed wetland restoration sites. No specific utilities have been identified that would have to be relocated, but the companies will not guarantee presence/absence. Considering this information, and the fact that several sites will require no excavation, utility relocation is not expected to be a major cost factor and the 25 percent construction contingency is expected to cover any unforeseen expenses.

The annualized costs for wetland restoration sites are summarized in Table 15.

Table 15. WETLAND RESTORATION COSTS

Location	Initial Construction Estimates [1.]	Total Construction Estimates [2.]	Land Costs [3]	Total Site Cost	AAEC [4]
Sugar Hill, Portsmouth	$85,501	$106,876	$2,500	$109,376	$7,400
Carolanne Farms, Virginia Beach	$198,905	$248,631	$14,000	$262,631	$17,700
Somme Avenue, Norfolk	$223,688	$279,610	$2,500	$282,110	$19,000
Scuffletown, Chesapeake	$54,905	$68,631	$2,500	$71,131	$4,900
NW Jordan Bridge, Portsmouth	$185,251	$231,564	$2,500	$234,064	$15,800
Crawford Bay, Portsmouth	$279,130	$348,913	$2,500	$351,413	$23,600
Woodstock Park, Virginia Beach	$377,390	$471,738	$2,500	$474,238	$31,800
Lancelot Drive, Virginia Beach	$1,242,463	$1,553,079	$6,000	$1,559,079	$104,300
Grandy Village, Norfolk	$791,528	$989,410	$5,000	$994,410	$66,600
ODU Drainage Canal, Norfolk	$138,236	$172,795	$2,500	$175,295	$11,900
Portsmouth City Park, Portsmouth	$263,295	$329,119	$11,000	$340,119	$22,900

[1] Construction estimates represent estimated projected costs. These values do not contain contingency or inflation factors. All figures are represented in FY 2001 dollars.

[2] Total construction estimates include an additional 25% contingency. This amount was added to the initial construction costs to cover any cost items not anticipated in the feasibility study.

[3] Land costs provided by Real Estate. See Real Estate Appendix B for description of costs.

[4] Average annual equivalent costs derived using an interest rate of 6-3/8%, assuming maintenance costs of $1,000 every five years over 50-year project life.

Sediment Clean-up - Cost Assumptions

The Norfolk District developed costs associated with the three different clean-up levels at Scuffletown Creek. Included in these estimates are the dredging, transporting, treatment, and disposal costs; estimates consider eight possible methods, or trains, of disposing the material. The different trains as outlined below are described in greater detail in a previous section of this report. In each of these trains, the first item represents the method of clean-up, the second represents transportation to the treatment site, and the third item is the temporary treatment location. The trains are grouped in sets of two because not all of the material will need remediation. Trains one, three, six, and seven, represent a system of removing, treating, and disposing contaminated material. These trains contain an additional step, listed below as treat, which represents the remediation or treatment process. The remaining trains (two, four, five, and eight) lack the remediation element because they describe a system of removing material that does not need treatment. These trains outline a method of removing the material and transporting it for direct placement in the final storage location. In addition to the outline below, these trains are displayed pictorially in Figure 21.

1. Dredge → Barge → CIDMMA[1] → Treat[2]/ Biocell → Landfill
2. Dredge → Barge → CIDMMA → Truck → Landfill

3. Dredge → Barge → Higgerson Buchanan → Treat → Landfill
4. Dredge → Barge → Higgerson Buchanan Placement

5. Dredge → Truck → Higgerson B. Placement
6. Dredge → Truck → Higgerson B. → Treat → Landfill

7. Dredge → Truck → ABEX → Treat → Landfill
8. Dredge → Truck → Landfill

[1]CIDMMA = Craney Island Dredged Material Management Area
[2]Treat = Stabilization or other treatment methodology

For the analysis, a conservative estimate was made that 50 percent of the material would need remediation and would, therefore, be processed through a train with the remediation element. The remaining 50 percent of the material was assumed to be immediately suitable for disposal and was assigned the costs of a train for direct deposits. The total volume of material dredged depends on the level of clean-up and the depth of contamination. As the clean-up level increases from 0.8 to 0.4 the total quantity dredged increases also (Table 12).

The costs associated with the different trains were computed on a per cubic yard basis. These costs include estimates for dredging the material in Scuffletown Creek, transportation to the temporary location, and temporary storage of the material. For the trains that include remediation, a "per cubic yard" cost was developed that includes treatment, transportation to the final location, and any costs associated with permanent storage. Remediation, as discussed previously in the report, was assumed to be performed by either a PUG technology (stabilization) or, in the case of CIDMMA, biotreatment at a biocell. The trains that consider temporary placement of material in CIDMMA (trains one and two) do not include the toll charge since the material will be removed and permanently stored in a landfill. (Dredged material cannot be placed permanently in CIDMMA, because the law authorizing CIDMMA specifies that dredged material deposited there permanently must be derived from navigation improvements. The environmental dredging, as proposed, does not qualify as a navigation improvement.) For the trains without remediation, costs were developed to include transportation to the permanent disposal location. Table 16 outlines the specific costs for each train.

Table 16. SEDIMENT REMOVAL, TREATMENT, AND DISPOSAL COSTS[1]

Train	Dredge + Barge/Truck + Temporary Placement [2]	Remediation + Transportation + Permanent Placement [2]	Transportation + Permanent Placement [2]
1	$20-25[3]	$125-127	N/A
2	$20-25	N/A	$67
3	$19-23	$124-126	N/A
4	$19-23	N/A	$9
5	$18-23	N/A	$13
6	$25-30	$122-124	N/A
7	$25-30	$120-122	N/A
8	$18-23	N/A	$65

[1] Costs are dependent on level of clean up. All given ranges encompass costs for each of the three levels. Total quantity of material ranges between 38,800 cy – 129,680 cy.
[2] Costs include dredging and transporting material from above and below the bridge. Removal of material above the bridge is more costly per cubic yard than removal of material below the bridge. ("bridge" is Railroad bridge which crosses Scuffletown Creek midway upstream)

[3] All costs represent prices per cubic yard.

As each train represents a different system of dredging, transporting, treating, and disposing of the material, all have different costs. In the analysis the trains were paired; half of the total material dredged was assumed to go through the remediation train, while the other half was assumed to be directly deposited.

The trains were paired as follows: 1 and 2, 3 and 4, 5 and 6, 7 and 8, and a cost was developed for each train pair. Investigations to date indicate that the material will most likely be taken to Craney Island or Higgerson Buchanan (train combinations 1 and 2, 3 and 4, or 5 and 6). Since the final method that will be used is currently uncertain, the train combination with the highest cost (trains 1 and 2) was used to evaluate each clean-up level. The estimates used in the analysis include dredging costs both above and below the bridge. All of the values in the table are per cubic yard costs. As the different decontamination levels require different volumes of material to be dredged, the total cost for each train is different for each clean-up alternative. Table 17 outlines the total costs of all the trains under each ERM SQV.

Table 17. TOTAL COSTS - SEDIMENT CLEAN-UP, ALL TRAINS, UNDER EACH ERM LEVEL

	ERM SQV, 0-6 foot depth		
Train (% material)	0.8	0.6	0.4
1 (50%)	2,950,412	4,481,002	9,463,512
2 (50%)	1,778,014	2,689,885	5,672,146
System Total[1] =	$4,728,426	$7,170,887	$15,135,657
3 (50%)	2,888,487	4,384,142	9,259,123
4 (50%)	625,831	899,272	1,822,980
System Total =	$3,514,318	$5,283,414	$11,082,103
5 (50%)	699,771	1,021,582	2,043,007
6 (50%)	2,991,290	4,551,087	9,574,779
System Total =	$3,691,061	$5,572,669	$11,617,786
7 (50%)	2,944,330	4,477,942	9,416,982
8 (50%)	1,705,014	2,583,078	5,402,802
System Total =	$4,649,344	$7,061,019	$14,819,784

[1] Assumes dredging above and below the bridge Includes an additional 25% contingency.

In addition to the dredging, treatment, and disposal costs, the analysis also considered maintenance costs over the 50-year project life. Costs have been included to allow for annual monitoring of the site during the first five years after project construction. Total monitoring costs of $60,000 include some limited evaluation of sediment contaminant levels, but primarily entails an evaluation of bottom community health using the B-IBI technology described previously. This monitoring will be supplemented by DEQ's ongoing monitoring of the Elizabeth River which began in 1998.

Costs for maintenance dredging are not included in the estimates because the gross contamination that occurred prior to current environmental regulations should no longer be a threat. Future contamination is unlikely since these historic sources have been removed.

Table 18 provides a summary of the annualized costs associated with the different sediment decontamination levels.

Table 18. SEDIMENT CLEAN-UP COSTS AND OUTPUTS

Increment	Total Construction Cost[1]	Functional Score [2]
0.8 Mean ERM SQV	$4,728,426	4.90
0.6 Mean ERM SQV	$7,170,887	7.84
0.4 Mean ERM SQV	$15,135,657	10.29

[1] First cost used are those of the train combination with the highest cost (trains 1 & 2)

[2] Full realization of benefits expected in year 3. Linear interpolation of benefits is assumed between years one and three. (Functional Score = see pages 106-111, Description of Environmental Benefits)

DESCRIPTION OF FORMULATION ALTERNATIVES – SEDIMENT RESTORATION

Introduction

Three alternative restoration plans, each associated with different levels, or degrees, of contaminated sediment clean-up, were considered for sediment restoration in Scuffletown Creek. Each sediment restoration plan consisted of dredging of contaminated sediments, transport by barge or truck of the dredged material to a dredged material management area, treatment, if necessary, of the dredged material by biocell or PUG (stabilization) technologies, and placement of the dredged material either on site at the dredged material management area or at a solid waste landfill.

The three restoration alternatives were differentiated in terms of the amount of material to be removed from the bottom of the Scuffletown Creek channel. In turn, the amounts of material to be removed have a direct bearing on the clean-up levels that can be achieved. As discussed previously, clean-up levels were defined in terms of mean ERM Sediment Quotient Values (SQV). Of the alternatives considered, a mean ERM SQV of 0.8 reflected the highest residual contaminant level remaining in the Scuffletown Creek substrate and least amount of sediment clean-up (minimum clean-up). A mean ERM SQV of 0.6 represented a medium level of residual contaminant and corresponding clean-up (medium clean-up), while a mean ERM SQV of 0.4 equated to the lowest level of residual contamination and highest level of clean-up considered (maximum clean-up).

Description of Costs

Each alternative restoration plan was characterized in terms of implementation costs and expected benefits. Implementation costs are a function of the cubic yards of sediment to be dredged, which is dependent on the required depth of dredging to remove contaminated sediments from the bottom of the channel; transport by barge or truck of materials to a dredged material management area whether or not remediation or treatment of the dredged material is required, based on degree of contamination at the management area; and ultimate disposal of the dredged material either on-site at the management area or transport of the material to a solid waste landfill. For each of the three alternatives, total implementation costs were calculated and average annual equivalent costs were derived (based on a 50-year project life, using a 6 3/8 % discount rate, and FY 2001 price levels). Because PED and construction management costs are proportionally the same regardless of which alternative is evaluated, these costs were not included during plan formulation.

Description of Environmental Benefits

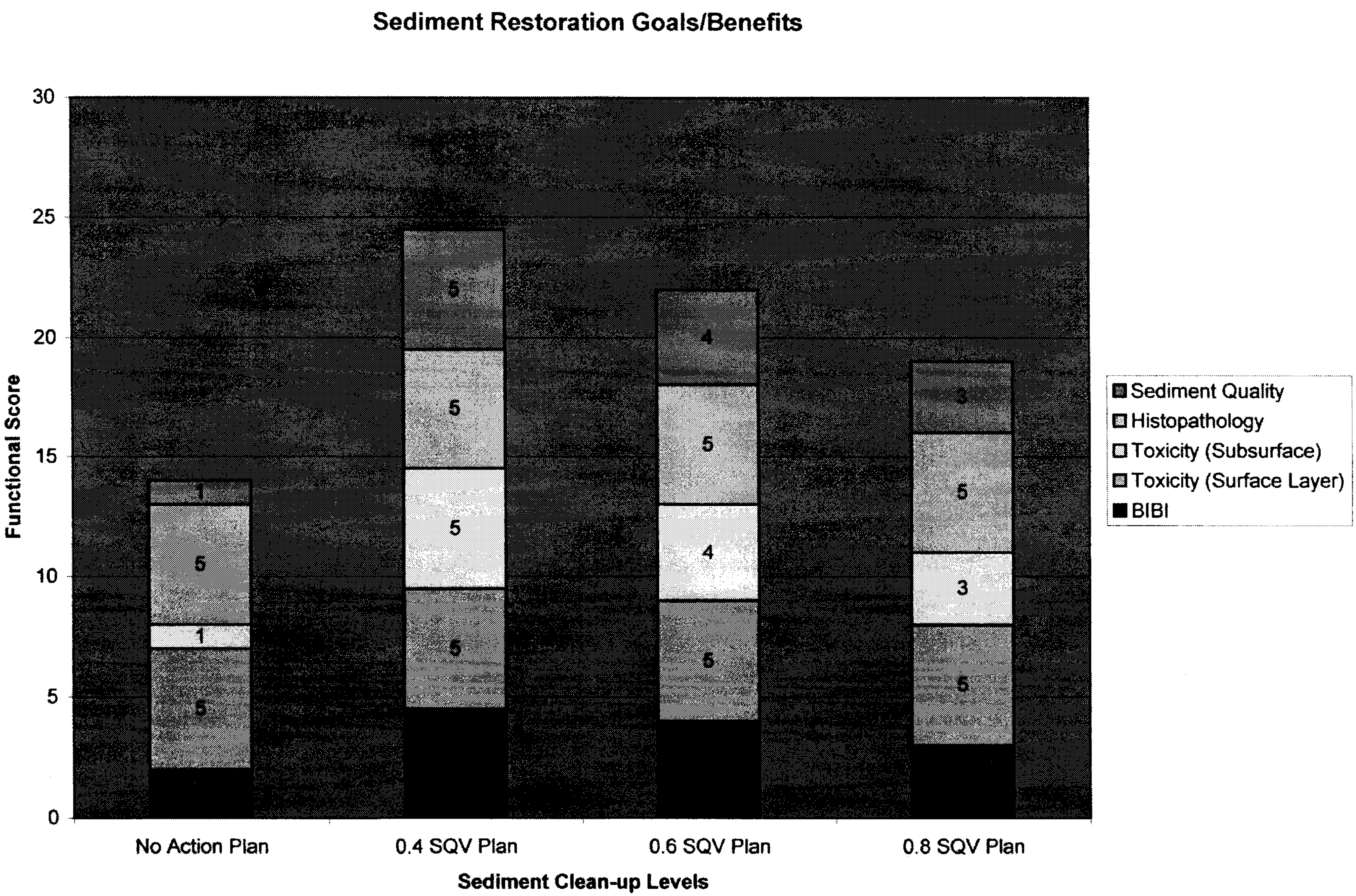
The benefits of each of the alternative restoration plans were characterized in terms of functional score outputs based on five separate measurements of the health of the Scuffletown Creek ecosystem. The five measurement techniques consisted of a benthic index of biotic integrity (B-IBI); the toxicity of the surface layer (1-2 cm deep) of bottom sediment to benthic (bottom dwelling) organisms; the toxicity of the sub-surface layer to same; histopathology and the presence of neoplasms (cancer) in fish species; and sediment quality as expressed as the presence of contaminant consituents in the sediment exceeding sediment quality criteria (TEL/ERL or PEL/ERM). The following table explains how these measurements indicate the relative health of the ecosystem.

Table 19. SEDIMENT RESTORATION INDICES AND EXPLANATIONS

Index of Sediment Restoration	Explanation
B-IBI	B-IBI is a multi-metric index that scores benthic community metrics (abundance, biomass, species diversity, etc.) compared to reference locations. Sediment clean-up can begin recovery of benthos (bottom dwelling organisms). Outputs related to improvement in B-IBI scores (indicative of improved benthic community health).
Toxicity of Surface Layer	Surface (surficial) layer defined as top 1- 2 cm of river bottom sediment. Some benthic organisms live on or in only this top layer. Fishes, etc., feed on these organisms. Surface layer typically less well consolidated (i.e., "fluff"), and often subject to change (both chemically and physically). Outputs related to toxicity reductions and more abundant, non-toxic, fish food in this layer.
Toxicity – Subsurface Layer	Subsurface layer defined as sediment below top 2 cm of surface. Subsurface layer often related to historical deposition of sediment. Deeper burrowing organisms, a variety of clams, worms and other invertebrates, inhabit these sediments. Outputs related to toxicity reductions and more abundant, diverse (deeper dwelling), non-toxic, fish food.
Histopathology - Fish tumors, cancers, and deformities	Contaminated sediment may contribute to fish tumors, cancers, deformities, and death. Clean-up that reduces contaminants will restore those populations and make fish less susceptible to these diseases. Outputs are related to healthier, more abundant and diverse fish populations.
Contaminated Bottom Sediment (Sediment Quality)	If contaminated sediment has contributed to degradation of fish and wildlife habitat, then reductions in gross levels of contaminants will lead to restoration of fish & wildlife populations. Outputs are related to reduction in contaminant levels and correlated restoration of fish & wildlife habitat and species populations.

A panel of subject matter experts (Sediment Subcommittee members) developed a functional numerical index in which the values recorded for each measurement technique were assigned a score of between 1 (poor) to 7 (excellent) to describe conditions of ecosystem health. For example, in characterizing the toxicity surface layer measurement technique, a functional index score of 1 (poor) would reflect high toxicity (less than 50% survival rate); a score of 3 (fair), moderate toxicity (50-80% survival rate); a score of 5 (good), low toxicity (over 80% survival rate); and a score of 7 (excellent), no toxicity (100% survival rate). See tables in Appendix C for a complete presentation of sediment restoration measurement techniques and corresponding functional index scores.

The expert panel judged the existing condition, the expected future without project condition, and the expected future conditions under the three alternative restoration plans, on the 1 to 7 scale for each of the five measurements of ecosystem health. The five separate functional index scores were weighted equally and then summed to provide a more complete representation of ecosystem health. The highest possible score (a functional score of 7 for all five measurement techniques) was therefore calculated to be a score of 35. Projected scores ranged from 14 for the without project future condition to 19 for the 0.8 mean ERM SQV alternative; 22 for the 0.6 mean ERM SQV alternative; and 24.5 for the 0.4 mean ERM SQV alternative. Expected functional scores under each alternative restoration plan were compared to the expected future without project score (and the difference calculated) to yield an overall numerical value of ecosystem improvement or benefit. The numerical functional scores were converted to an average annual value to reflect the fact that full ecosystem benefits would not occur until year three of the project life. The functional score and habitat benefits of each of the alternative restoration plans are displayed in Figure 24 and Table 20.



Sediment Restoration Goals/Benefits
Functional Score
30
25
20
15
10
5
0
5
5
5
5
5
4
5
4
5
3
5
3
5
1
5
1
5
Sediment Quality
Histopathology
Toxicity (Subsurface)
Toxicity (Surface Layer)
BIBI
No Action Plan
0.4 SQV Plan
0.6 SQV Plan
0.8 SQV Plan
Sediment Clean-up Levels

FIGURE 24

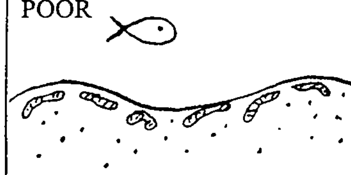
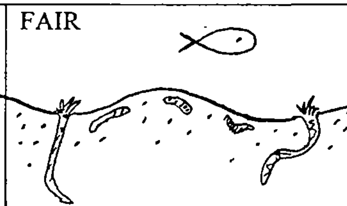
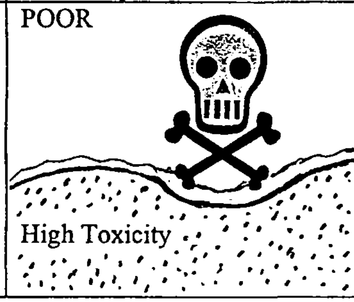
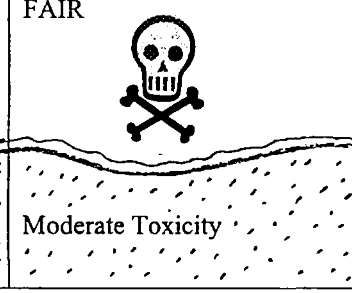
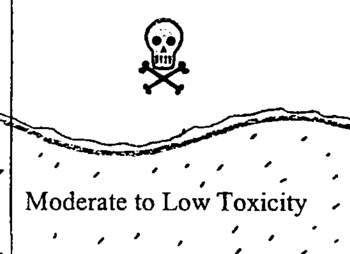
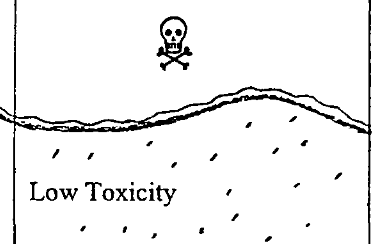
Benefit Measure	Base Condition	0.8 SQV Minimum Level of Clean-Up	0.6 SQV Medium Level of Clean-Up	0.4 SQV Maximum Level of Clean-Up
Sediment Quality	Many Contaminants Present at High Levels POOR	Some Contaminants Present – Lower levels FAIR	Fewer Contaminants Present– Lower levels GOOD to FAIR	Fewest Contaminants Present– Lower levels GOOD
Fish Cancer and Precancer	REDUCED  CANCERS AND PRECANCERS			
Bottom Community Health	POOR  Primarily <u>one</u> pollution-tolerant species	FAIR  - Less Abundance & Diversity - Few Deep Dwelling Forms	GOOD TO FAIR  - Greater Abundance & Diversity - More Deep Dwelling Forms	GOOD  - Closest to Reference Conditions (Ches. Bay)
Toxicity of Subsurface Sediments to Bottom Dwelling Organisms	POOR  High Toxicity	FAIR  Moderate Toxicity	GOOD TO FAIR  Moderate to Low Toxicity	GOOD  Low Toxicity

Table 20. BENEFITS RELATED TO THREE LEVELS OF SEDIMENT CLEAN-UP

Table 21. PERCENTAGE IMPROVEMENTS RELATED TO SEDIMENT CLEAN-UP IN SCUFFLETOWN CREEK

Location	Percent Degraded (BIBI)[1]	Toxicity of Sub Surface Sediments
All Virginia Tidal Waters	30	N/A[2]
Main Stem Elizabeth	52	N/A
Eastern Branch	64	N/A
Southern Branch	92	N/A
Western Branch	72	N/A
Base Condition in Scuffletown Creek	76	0-40% survival (high toxicity)
Clean-up Levels in Scuffletown Creek		
0.8 SQV (minimum level of cleanup)	50-60 (21-34% improvement[3])	40-60% survival (0-20% improvement)
0.6 SQV (medium level of cleanup)	40-50 (34-47% improvement)	60-80% survival (20-40% improvement)
0.4 SQV (maximum level of cleanup)	30-40 (47-60% improvement)	>80% survival (>40% improvement)

[1] Benthic Index of Biotic Integrity – measure of bottom community diversity and health
[2] Information not available
[3] Percent improvement over the base condition

The Chesapeake Bay Agreement 2000, signed by the governors of Maryland, Pennsylvania, and Virginia, the Mayor of Washington, D.C., the EPA Administrator, and the Chairman of the Chesapeake Bay Commission, identifies the Elizabeth River as a "Priority Urban Water", "...supporting its restoration as (a) model for urban river restoration in the (Chesapeake) Bay basin". The complementary Toxics 2000 Strategy (for chemical contaminant reduction, prevention, and assessment) identifies as priority work to be accomplished: "...Clean-up contaminants in the sediment in the three Regions of Concern". The sediment clean-up benefits as described previously in this report will contribute, in an unprecedented way, to the accomplishment of the goals as set forth in these agreements.

DESCRIPTION OF FORMULATION ALTERNATIVES – WETLANDS RESTORATION

Introduction

The 905(b) Analysis (Reconnaissance Study) recommended that 19 candidate wetland sites, at various locations along the main, Eastern, Southern, and Western Branches of the Elizabeth River, be evaluated for restoration feasibility. As a result of feasibility investigations, however, eight of the 19 sites were eliminated from further consideration. Reasons for discontinuing sites from further analysis included the following: sites held exclusively by private property owners, entailing sometimes problematic private property issues that local sponsors were reluctant to tackle; site constraints such as buildings, public roadways, and utilities that did not allow adequate space for the development of a viable wetland restoration project; former landfill sites that would have required excavation and may have exposed unknown contaminated materials; former industrial uses at a site in which the soils had been contaminated with petroleum hydrocarbons and semi-volatile organic compounds, the restoration of which via constructed wetlands may have created a more efficient conduit for these chemicals to enter the river; a mature wooded site possessing desirable habitat values and riparian buffer characteristics that would have been lost through conversion of the site to wetlands; and a site with complex, unresolved stormwater management issues. Elimination of these sites from further consideration left 11 remaining candidate wetlands restoration sites.

Various scales at each of the restoration sites were not considered. In most cases, the sites are so geographically constrained by existing urban development and infrastructure that breaking down the site into smaller components would not be feasible from an ecological standpoint. In other words, the wetland sites require certain minimum areas to function effectively, to self-regulate, and to maintain structure. Since 9 of the 11 proposed restoration sites vary in size from just 0.33 to 1.6 acres, study team wetlands ecologists determined that breaking these sites down into smaller scales would threaten their integrity and probability of success. The other driving factor that determined site size was that each site was configured so as to be contiguous with other adjacent, undisturbed, wetland areas. Reducing site size often meant losing its connection with an existing wetland, thereby reducing the overall ecosystem benefit. The cost effectiveness and incremental cost analyses (CE/ICA) was performed, therefore, between candidate sites, rather than among various scales within candidate sites.

Description of Costs

Each alternative restoration plan was characterized in terms of implementation costs and expected benefits. Implementation costs at all sites include site preparation, earthwork, and landscaping categories. Site preparation costs includes mobilization, brush clearing, timber matting, stone, erosion control, and demobilization. The earthwork category includes all costs for either excavation or filling (including either disposing of or acquiring material), as applicable at each site. Landscaping includes all costs associated with constructing the wetland, such as topsoil, plants, and planting of native marsh vegetation. In addition to construction costs, real estate acquisition costs were considered and included in the analysis. Maintenance costs, which entail periodic monitoring, were also included. For each of the alternative sites, total implementation costs were calculated and average annual equivalent costs (based on a 50-year project life, using a 6 3/8 % discount rate and FY 2001 price levels) were derived. Because PED and construction management costs are proportionally the same regardless of which alternative is evaluated, these costs were not included during plan formulation.

Description of Environmental Benefits

The environmental outputs (and associated benefits) of each of the alternative restoration sites were characterized in terms of two assessment methodologies: a Habitat Evaluation Procedure (HEP) and a wetlands functional assessment score. The HEP methodology, in widespread use since first developed by the U.S. Fish and Wildlife Service in the early 1980's, compares the suitability of habitat conditions in the study area for a particular species, to ideal conditions for that same species. HEP takes into account both the quality and quantity of habitat by multiplying a species-specific numerical habitat suitability index (HSI) by the areal extent of the habitat under consideration. The HSI value, which varies from 0 to 1 ("0" represents no value as habitat, while "1" represents ideal habitat), is multiplied by acreage to yield habitat units. Habitat units serve as a quantitative expression of environmental output.

For the Elizabeth River wetlands, several avian, mammalian, and fish species HSI models were initially considered in evaluating the quantity and quality of wetlands habitat. However, because in most cases the models' requirements did not fit the river and shoreline conditions in the urban and industrial sites proposed for restoration, only one avian species, the clapper rail (*Rallus longirostris*), was selected. The clapper rail was considered an appropriate "indicator species" (i.e., a species indicative of overall wetlands ecosystem health) both because the emergent marsh and shoreline habitat are critical habitat for a number of important bird species, and because the clapper rail has multiple life requisite factors (food, cover, reproduction, water) within the proposed restoration habitats identified.

The candidate restoration sites were inventoried by the study team and measured in terms of habitat variables (i.e., percentage of total area covered by persistent salt or brackish emergent or scrub/shrub wetlands) critical to supporting the life requisites of the clapper rail. Using the USFWS *Habitat Suitability Index Models: Clapper Rail*, an HSI value was calculated for each restoration site, which was then multiplied by site acreage to yield the number of habitat units. At each site, the expected number of habitat units to occur in the future in the absence of the restoration project was subtracted from the number of habitat units expected to occur with the restoration project. That difference in habitat units or outputs (between with and without project conditions) represents the "benefits" due to the site restoration. The outputs are the things measured; the benefits are the values given to those measurements. This methodology is appropriate and consistent with the intent of ER 1165-2-501 to utilize appropriate indicators and units to measure the quality and/or quantity of the habitat-related outputs and associated benefits. See HEP tables in Appendix C for a detailed breakdown of future without project and with project HSI values and habitat units by wetlands restoration site. The habitat units were converted to average annual value units to reflect the fact that full ecosystem benefits would not occur until year three of the project life.

Figure 25 portrays the average annual habitat units for each of the wetland sites expected to occur in the future both with and without the project.

The second methodology employed to assess the environmental outputs and associated benefits of each of the alternative restoration sites is a wetlands functional assessment score. The concept behind the functional assessment is to capture the range of beneficial functions provided by wetlands systems, such as the capacity of wetlands to produce plant material to support aquatic food chains, to provide fish and wildlife habitat, to improve water quality, to reduce shoreline erosion and help reduce shoreline flooding, and to improve community aesthetics and provide educational opportunities. A panel of subject matter experts (composed of biologists from the COE, the USFWS, and VIMS), developed a functional numerical index in which the values recorded for each of seven wetlands functions were assigned a score of between 1 (low) to 5 (high) to describe how well each wetlands site performs a specific function. The wetlands functions considered include: 1) primary production, measured by organic production, decomposition, and availability of plant material food to aquatic organisms; 2) fish and wildlife habitat, as measured by tidal regime, ratio of cover to open water, ratio of shoreline to wetland area, and cover type diversity; 3) water quality, characterized by watershed area, detention time, width of wetland, percent cover, and stormwater features; 4) erosion buffer, as measured by vegetative cover type, width of marsh, slope of marsh, and elevation of marsh; 5) flood buffer, measured by storm tide volume and floodplain width; 6) aesthetics, characterized by "greenspace" availability, existing degradation, and site visibility; and 7) public accessibility and educational value, characterized by accessibility of site, proximity to schools and neighborhoods, and recreational opportunities. See Functions Outputs Tables in Appendix C for a complete description of wetlands functional definitions, measures, and index scores.

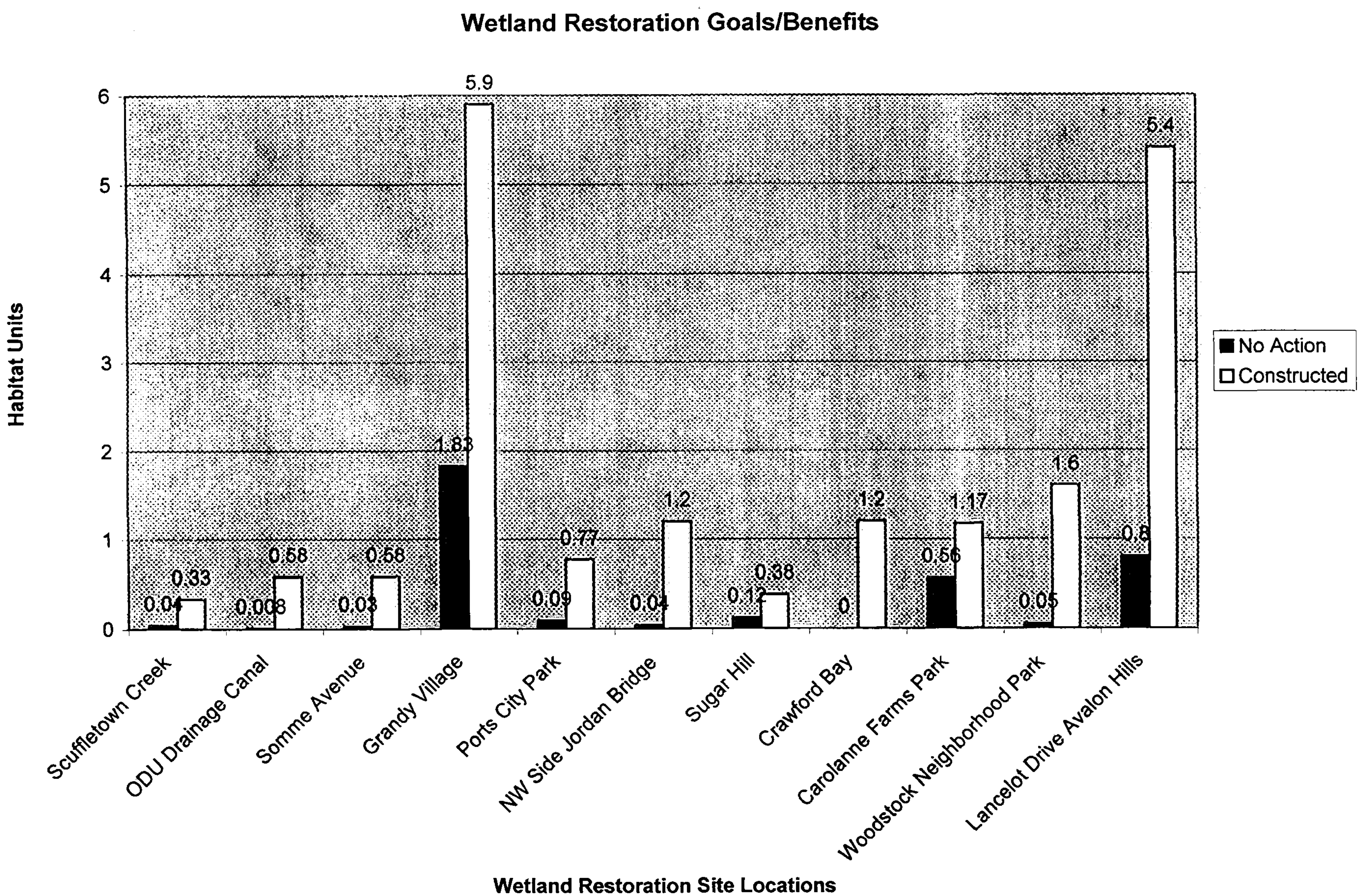

Wetland Restoration Goals/Benefits
Habitat Units
0
1
2
3
4
5
6
0.04
0.33
0.008
0.58
0.03
0.58
1.83
5.9
0.09
0.77
0.04
1.2
0.12
0.38
0
1.2
0.56
1.17
0.05
1.6
0.8
5.4
No Action
Constructed
Scuffletown Creek
ODU Drainage Canal
Somme Avenue
Grandy Village
Ports City Park
NW Side Jordan Bridge
Sugar Hill
Crawford Bay
Carolanne Farms Park
Woodstock Neighborhood Park
Lancelot Drive Avalon Hills
Wetland Restoration Site Locations

FIGURE 25

The expert panel judged the existing condition, the expected future without project condition, and the expected future with project conditions for the 11 alternative restoration sites, on the 1 to 5 scale for each of the seven measurements of wetlands functions. The seven separate functional index scores were weighted equally and then summed to provide a more complete representation of how well each wetland site contributed across wetland functions. The highest possible score (a score of 5 for all seven functions) was therefore calculated to be a score of 35. Functional scores at each site were then multiplied by acreage at that site to reflect the fact that the functional benefits provided would be proportional to the size of the wetlands. This proportionality technique is analogous to the habitat unit concept, in which both quality and quantity are important factors in the determination of environmental outputs. Projected scores at each site ranged from 0 to 60.9 for the without project future condition; and from 8.58 to 231.0 for the with project future condition. Expected functional scores under each alternative restoration site were compared to the expected future without project score (and the difference calculated) to yield an overall numerical value of wetlands improvement or benefit. Figure 26 graphically displays the wetlands functional values or "scores" for each of the wetlands sites expected to occur in the future both with and without the project.

Wetland Functional Assessment

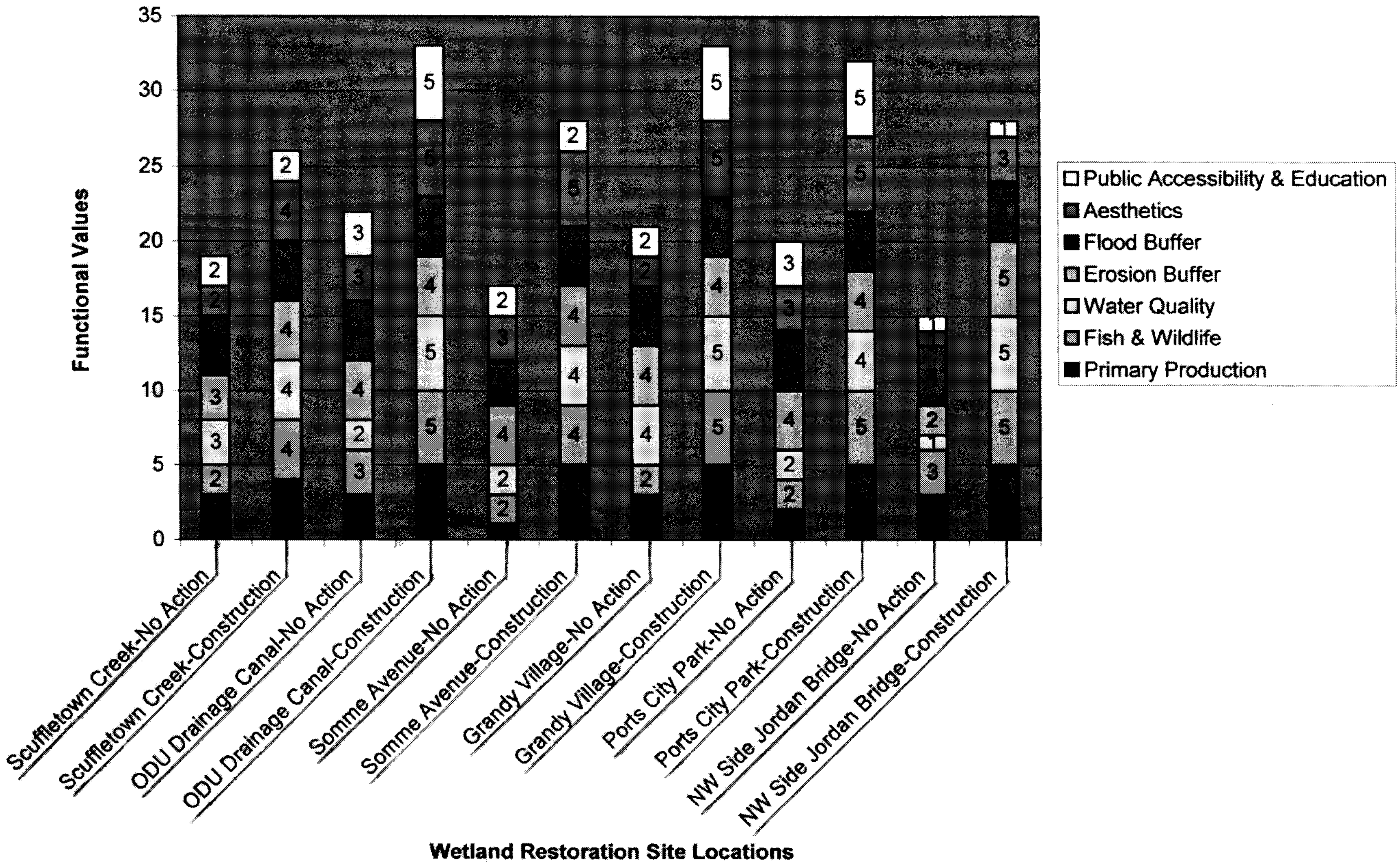


FIGURE 26

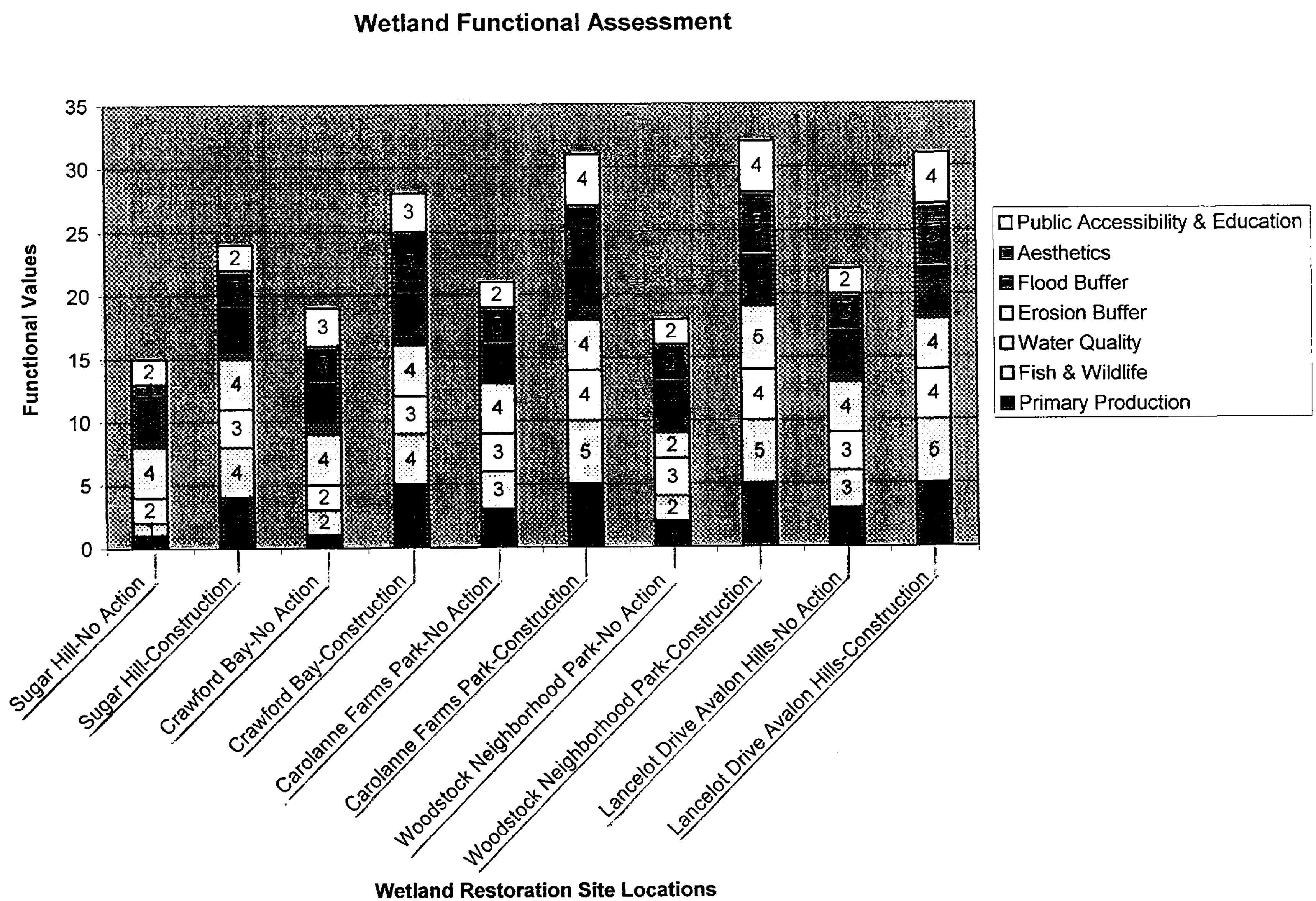


FIGURE 26 (CONT'D)

The numerical functional scores were converted to an average annual value to reflect the fact that full ecosystem benefits would not occur until year three of the project life. The average annual functional assessment score outputs of each of the alternative restoration sites are displayed in the table below.

Table 22. ELIZABETH RIVER ENVIRONMENTAL RESTORATION WETLANDS RESTORATION COSTS AND OUTPUTS

Location	Total Implementation Costs	Average Annual Costs[1]	Annual Habitat Units (from HEP)[2]	Annual Functional Value Score[2]
Sugar Hill, Portsmouth	$109,376	$7,400	0.25	7.06
Carolanne Farms, VA Beach	$262,631	$17,700	1.05	32.54
Somme Avenue, Norfolk	$282,110	$19,000	0.54	14.75
Scuffletown, Chesapeake	$71,131	$4,900	0.28	6.92
NW Jordan Bridge, Portsmouth	$234,064	$15,800	1.14	31.61
Crawford Bay, Portsmouth	$351,413	$23,600	1.18	35.67
Woodstock Park, VA Beach	$474,238	$31,800	1.52	48.24
Lancelot Drive, VA Beach	$1,559,079	$104,300	4.49	133.25
Grandy Village, Norfolk	$994,410	$66,600	3.99	166.7
ODU Drainage Canal, Norfolk	$175,295	$11,900	0.56	18.76
Portsmouth City Park, Portsmouth	$340,119	$22,900	0.67	23.52
TOTAL	$4,853,865	$325,900	15.67	519.02

[1] Average annual equivalent costs derived using an interest rate of 6-3/8%.

[2] Full realization of benefits is anticipated in year 3. Linear interpolation of benefits is assumed between years one and three.

IX. COST EFFECTIVENESS AND INCREMENTAL COST ANALYSIS

In order to make more informed decisions with regard to the development and eventual selection of the National Environmental Restoration (NER) Plan, the study team has utilized two decision-making techniques called cost effectiveness analysis and incremental cost analysis, as required by Corps Planning Guidance. Cost effectiveness analysis identifies that plan, or plans, which produces the greatest level of environmental output for the least cost. (The environmental outputs, however measured, in turn reflect the environmental benefits such as biological diversity, fish and wildlife habitat, nutrient cycling provided by the plan, or plans.) Incremental cost analysis examines the changes in costs and changes in environmental outputs for each additional increment of environmental output. The "Best Buy" plans represent those plans that produce the greatest levels of environmental output for the least cost and the greatest increases in environmental outputs for the least increases in costs. The Institute of Water Resources (IWR), a Field Operating Activity (FOA) of the COE, accomplished these two analyses for this study.

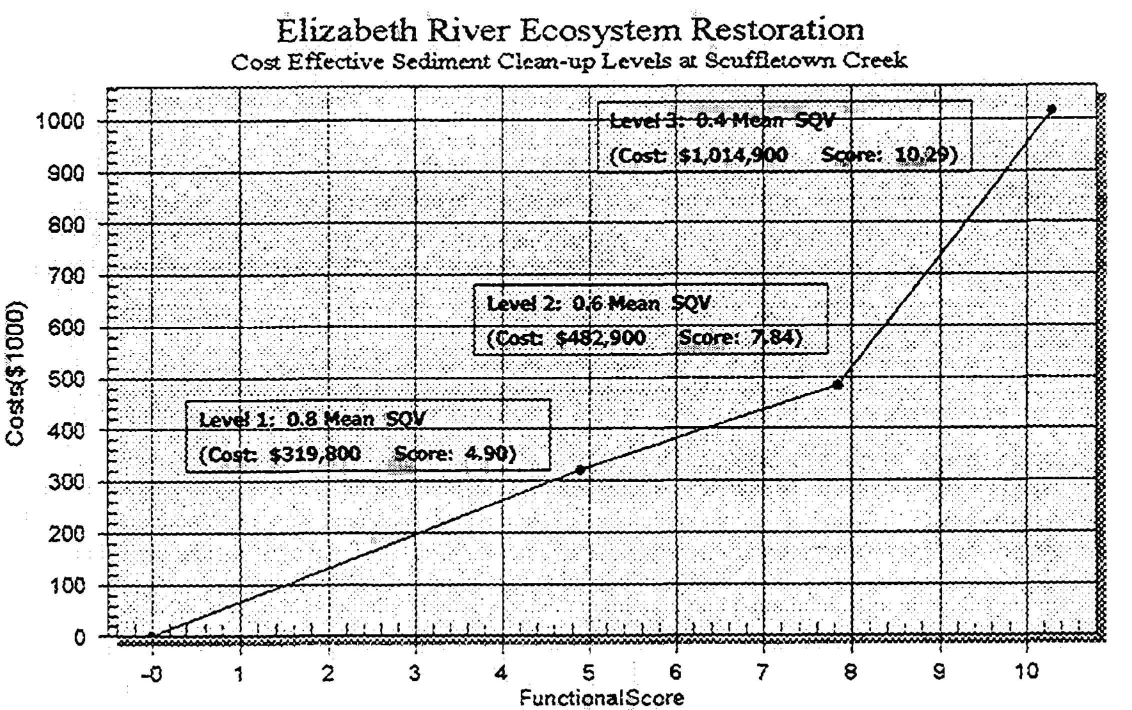
Sediment Restoration Plans

The average annual equivalent costs and average annual outputs (functional scores) were used to conduct cost effectiveness and incremental cost analyses for the three sediment restoration plans. Because the three plans are mutually exclusive (i.e., bottom sediment would be cleaned up to <u>either</u> the 0.8, 0.6, or 0.4 mean ERM SQV levels), the two analyses are relatively straightforward. Cost effectiveness analysis indicates that all three restoration plans, as well as the "No Action" alternative, are cost effective in that each plan is the least costly means of providing the associated level of output or benefit. The table below shows annual outputs (functional score points), annual costs, and average costs per functional score point for each alternative.

Table 23. SEDIMENT RESTORATION: RESULTS OF COST EFFECTIVENESS ANALYSIS

Alternative Plan	Functional Score (Points)	Annual Costs	Average Cost (Cost/ Point)
No Action	0	0	N/A
0.8 Mean ERM SQV Clean-up Level	4.90	$319,800	$65,265
0.6 Mean ERM SQV Clean-up Level	7.84	$482,900	$61,594
0.4 Mean ERM SQV Clean-up Level	10.29	$1,014,900	$98,630

Figure 27. SEDIMENT RESTORATION: COST EFFECTIVE PLANS



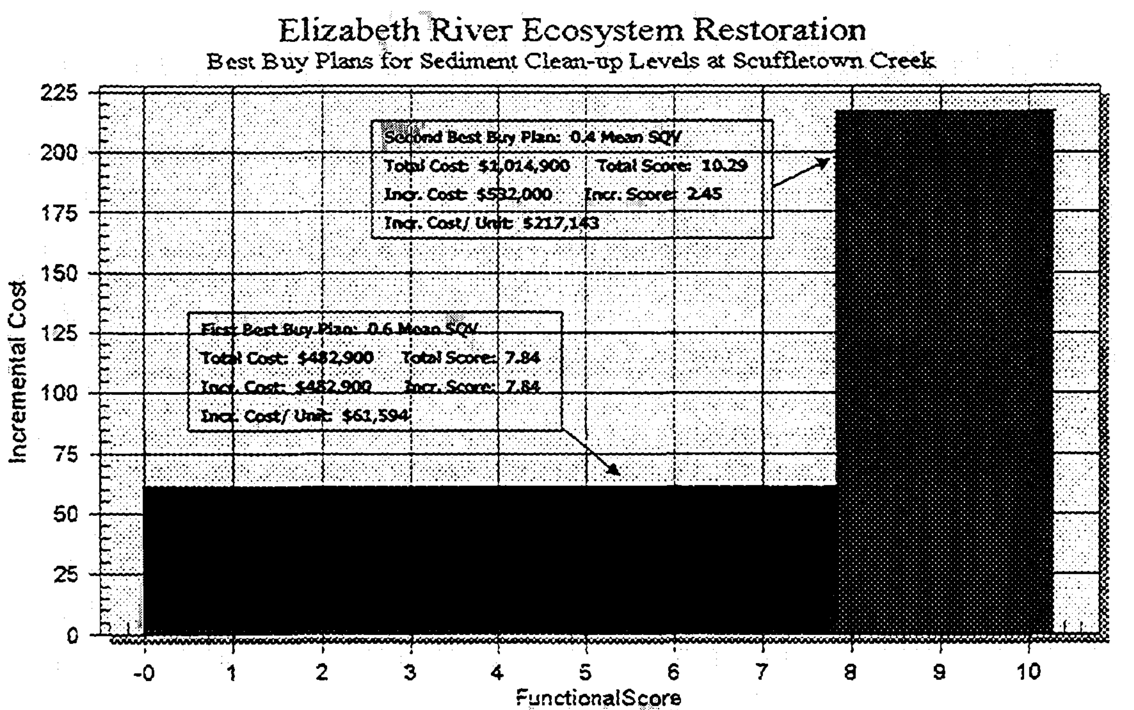
After conducting the cost effectiveness analysis, incremental cost analysis examines the changes in costs and changes in environmental outputs (in this case, functional score points) for each additional increment of output. The first step is, starting from the "No Action" alternative, to calculate the incremental change in costs and the incremental change in outputs of moving from the "No Action" alternative to each of the cost effective plans. The change in costs divided by the change in outputs is calculated to generate an average cost per unit of output (in this case, average cost per functional score point) for each of the cost effective plans. The plan with the lowest overall average cost per unit of output is the first "Best Buy" plan. Table 23 shows that the alternative with the lowest overall average cost is the medium clean-up level alternative (0.6 mean ERM SQV). This medium clean-up level plan has an average cost of $61,594 per functional score point, which is a lower average cost than the low clean-up level alternative (0.8 mean ERM SQV) at an average cost of $65,265 per functional score point. The medium level clean-up alternative is therefore the first "Best Buy" plan.

After the first "Best Buy" plan is identified, subsequent incremental analyses calculate the change in costs and change in outputs of moving from the first "Best Buy" to all remaining (and larger) cost effective plans. Again, changes in costs are divided by changes in outputs for each increment to identify the plan with the next lowest incremental cost per unit of output. The plan thus identified is the second "Best Buy" plan, and the process continues. For the Scuffletown Creek sediment restoration alternatives, the alternative with the next lowest incremental cost per unit of output (as output is increased) is the only remaining alternative: the highest level clean-up (0.4 mean ERM SQV). This alternative, which is the second "Best Buy" plan, costs an additional $532,000 over the 0.6 ERM SQV alternative, provides an additional 2.45 points on the clean-up functional score, and costs $217,143 per point for those additional 2.45 points. Table 24 summarizes information from the incremental analysis of the sediment restoration alternatives and Figure 28 displays that information graphically.

Table 24. SEDIMENT RESTORATION: RESULTS OF INCREMENTAL COST ANALYSIS

Alternative Plan	Functional Score (Points)	Annual Costs	Average Cost ($/ Point)	Incre-mental Cost	Incre-mental Functional Score (Points)	Incremental Cost Per Unit ($/ Point)
No Action	0	0	N/A	0	0	N/A
First "Best Buy" Plan: 0.6 Mean ERM SQV Clean-up Level	7.84	$482,900	$61,594	$482,900	7.84	$61,594
Second "Best Buy" Plan: 0.4 Mean ERM SQV Clean-up Level	10.29	$1,014,900	$98,630	$532,000	2.45	$217,143

Figure 28. SEDIMENT RESTORATION: "BEST BUY" PLANS



Wetland Restoration Plans

The average annual equivalent costs and average annual outputs (both habitat units and wetlands functional scores) were used to conduct cost effectiveness and incremental cost analyses. The first step in the analysis is to identify all possible alternative plan combinations based on the number of individual restoration sites, whether the sites can be combined with each other (i.e., implemented in tandem), and whether any of the sites are dependent on each other. Because none of the Elizabeth River wetlands restoration sites are dependent on each other (i.e., all can be implemented independently) and all are "combinable" with each other (i.e., none are mutually exclusive), the 11 restoration sites can be put together in 2,048 separate plan combinations. For example, the very smallest alternative plan (in terms of habitat units) other than the "No Action" alternative consists of restoring only the Sugar Hill site, yielding 0.25 habitat units, while the very largest plan (also in terms of habitat units) consists of implementing all 11 sites, yielding 15.67 habitat units. In between these two extremes are 2,046 other plan combinations.

After building all possible plan combinations, cost effectiveness analysis was conducted. "Cost effective" means that, for a given level of environmental output (i.e., in this study, habitat units or wetlands functional index score), no other plan costs less. Similarly, no other plan yields more habitat units or functional index points for less money. Cost effectiveness analysis indicates that, under the habitat assessment, 80 alternative restoration plans, including the "No Action" alternative, are cost effective. Under the wetlands functional assessment, 106 alternative restoration plans, including the "No Action" alternative, are cost effective. These cost effective plans range from implementation of just the Scuffletown Creek site (producing 0.28 habitat units, and 6.92 wetlands functional score units, at an average annual cost of $4,900), to the largest alternative plan, implementation of all 11 sites (producing 15.67 habitat units, and 519.02 functional score units, at an average annual cost of $325,900). The "largest" plan, in terms of output, is considered cost effective because no other alternative plan produces the same or more output for less cost. Figure 29 displays cost effective plans (in terms of habitat units) graphically. Figure 30 shows the same data but employs the wetlands functional assessment to express environmental outputs.

Figure 29. WETLANDS RESTORATION: COST EFFECTIVE PLANS (HABITAT ASSESSMENT)

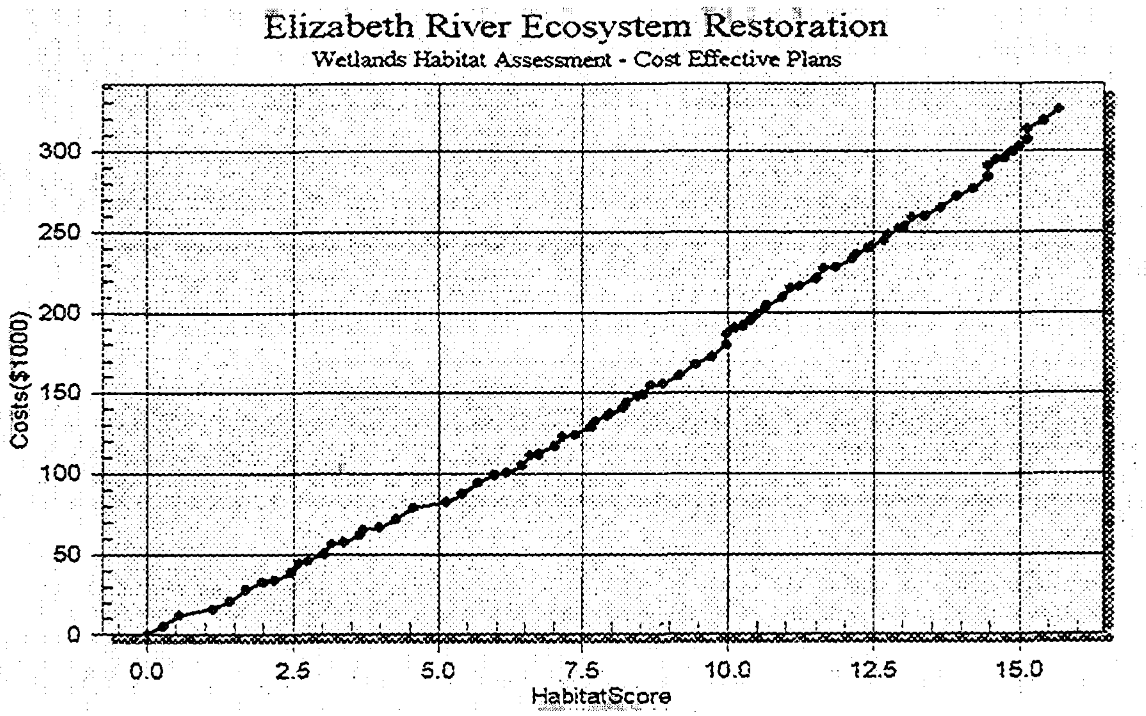
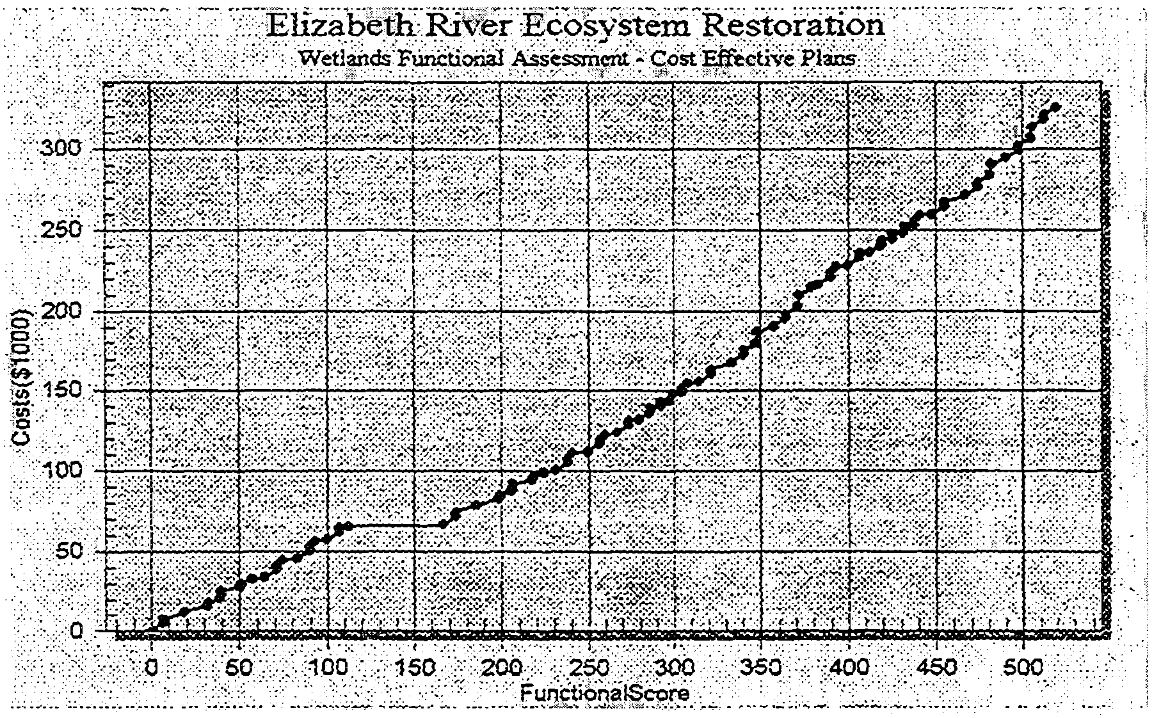


Figure 30. WETLANDS RESTORATION: COST EFFECTIVE PLANS (FUNCTIONAL ASSESSMENT)

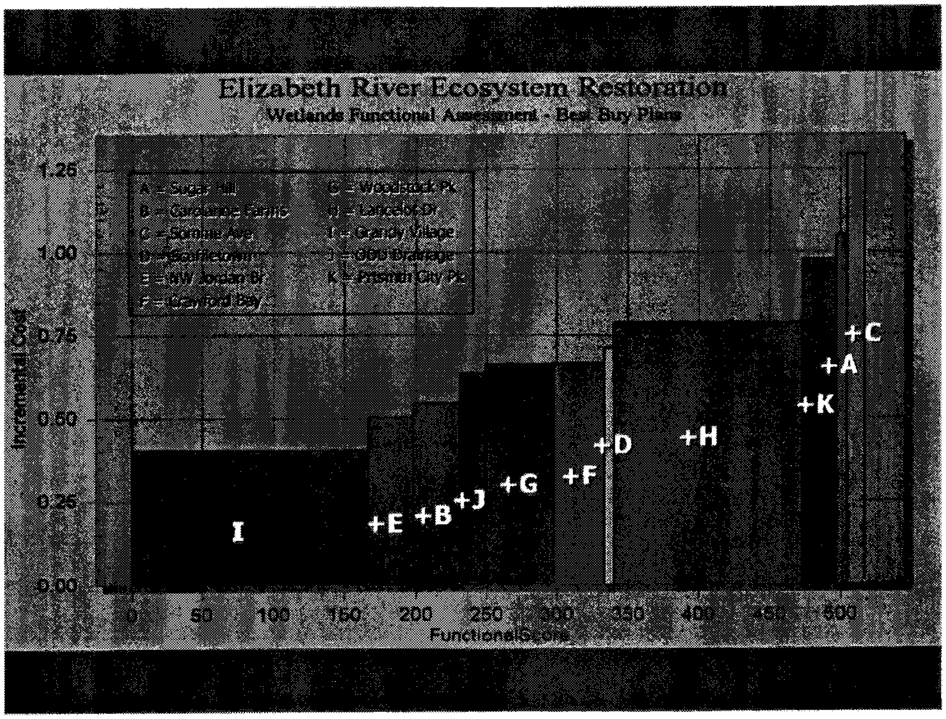


After conducting cost effectiveness analysis, incremental cost analysis examines the changes in costs and changes in environmental outputs (in this case, habitat units or wetlands functional score units) for each additional increment of output. The first step is, starting from the "No Action" alternative, to calculate the incremental change in costs and the incremental change in outputs of moving from the "No Action" alternative to each of the cost effective plans. The change in costs, divided by the change in outputs, is calculated to generate an average cost per unit of output (in this case, average cost per habitat unit or functional score unit) for each of the cost effective plans. The plan with the lowest overall average cost per unit of output is the first "Best Buy" plan. For habitat assessment, the alternative with the lowest overall average cost is implementing just the NW side of Jordan Bridge site, with an average cost of $13,860 per habitat unit. This is in fact a lower average cost than two smaller cost effective plans (implementing just Scuffletown Creek, and implementing just ODU Drainage Canal). Implementing the NW side of Jordan Bridge site is therefore the first "Best Buy" plan using the habitat assessment methodology. For wetlands functional assessment, the alternative with the lowest overall average cost is implementing just the Grandy Village site, with an average cost of $400 per functional score unit, which is in fact a lower average cost than 23 smaller cost effective plans. Implementing the Grandy Village site is therefore the first "Best Buy" plan using the wetlands functional assessment methodology.

After the first "Best Buy" plan is identified, subsequent incremental analyses calculate the change in costs and change in outputs of moving from the first "Best Buy" to all remaining and larger cost effective plans. Again, changes in costs are divided by changes in outputs for each increment to identify the plan with the next lowest incremental cost per unit of output. The plan thus identified is the second "Best Buy" plan, and the process continues. For the habitat assessment, the alternative with the next lowest incremental cost per unit of output (as output is increased) is implementing NW Jordan Bridge *plus* implementing Grandy Village. This alternative, which is the second "Best Buy" plan, costs an additional $66,600 over just implementing the NW Jordan Bridge site, provides an additional 3.99 habitat units, and costs $16,692 per habitat unit for those additional 3.99 habitat units. For the wetlands functional assessment, the alternative with the next lowest incremental cost per unit of output (as output is increased) is implementing Grandy Village *plus* implementing NW Jordan Bridge. This alternative, which is the second "Best Buy" plan, costs an additional $15,800 over just implementing the Grandy Village site, provides an additional 31.61 functional score units, and costs $500 per functional score unit for those additional 31.61 units. Tables 25 and 26 summarize information from the incremental analysis of the wetlands restoration alternatives (using habitat assessment and wetlands functional assessment, respectively) and Figures 31 and 32 display that information graphically.

Table 25. WETLANDS RESTORATION: RESULTS OF INCREMENTAL COST ANALYSIS (HEP ASSESSMENT)

Alternative Plan	Habitat Units	Annual Costs	Average Cost ($/ HU)	Incre-mental Cost	Incre-mental Habitat Units	Incremental Cost Per Habitat Unit ($/ HU)
"No Action"	0	0	N/A	0	0	N/A
First "Best Buy" Plan: NW Jordan Bridge	1.14	$15,800	$13,860	$15,800	1.14	$13,860
Second "Best Buy" Plan: (All the Above) + Grandy Village	5.13	$82,400	$16,062	$66,600	3.99	$16,692
Third "Best Buy" Plan: (All the Above) + Carolanne Farms	6.18	$100,100	$16,197	$17,700	1.05	$16,857
Fourth "Best Buy" Plan: (All the Above) + Scuffletown Creek	6.46	$105,000	$16,254	$4,900	0.28	$17,500
Fifth "Best Buy" Plan: (All the Above) + Crawford Bay	7.64	$128,600	$16,833	$23,600	1.18	$20,000
Sixth "Best Buy" Plan: (All the Above) + Woodstock Park	9.16	$160,400	$17,511	$31,800	1.52	$20,921
Seventh "Best Buy" Plan: (All the Above) + ODU Drainage Canal	9.72	$172,300	$17,726	$11,900	0.56	$21,250
Eighth "Best Buy" Plan: (All the Above) + Lancelot Drive	14.21	$276,600	$19,465	$104,300	4.49	$23,229
Ninth "Best Buy" Plan: (All the Above) + Sugar Hill	14.46	$284,400	$19,640	$7,400	0.25	$29,600
Tenth "Best Buy" Plan: (All the Above) + Portsmouth City Park	15.13	$306,900	$20,284	$22,900	0.67	$34,179
Eleventh "Best Buy" Plan: (All the Above) + Somme Ave	15.67	$325,900	$20,798	$19,000	0.54	$35,185



A = Sugar Hill; B = Carolanne Farm: C = Somme Ave; D = Scuffletown; E = NW Jordan Bridge; F = Crawford Bay;
G = Woodstock Park; H = Lancelot Dr; I = Grandy Village; J = ODU Drainage Canal; K = Portsmouth City Pk.

FIGURE 31 . <u>WETLANDS RESTORATION: BEST BUY PLANS (FUNCTIONAL ASSESSMENT)</u>

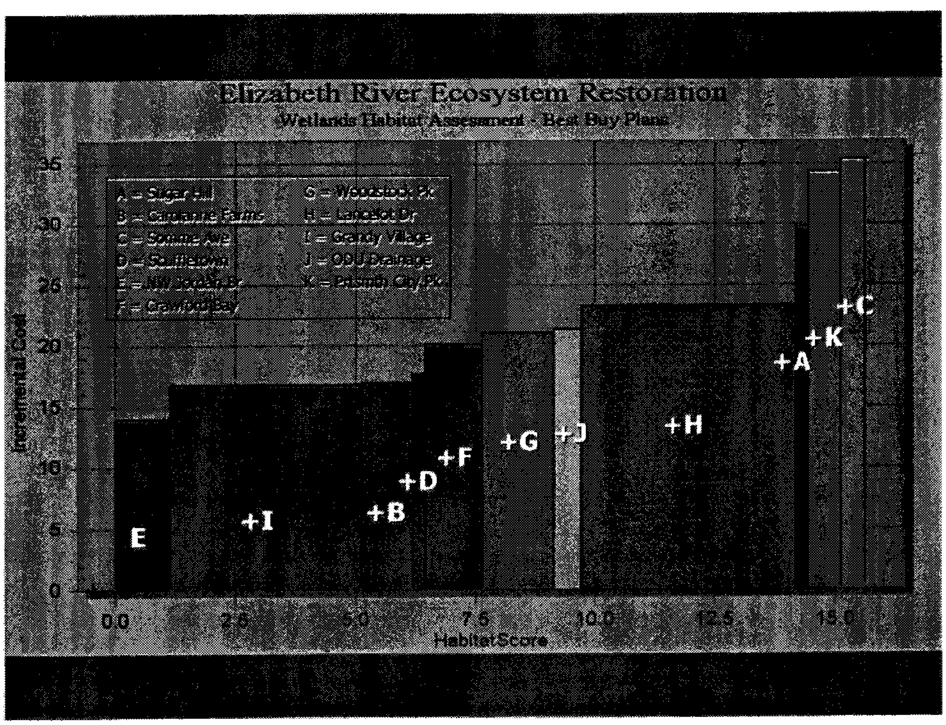


FIGURE 32. <u>WETLANDS RESTORATION: BEST BUY PLANS (HEP ASSESSMENT)</u>

Table 26. WETLANDS RESTORATION: RESULTS OF INCREMENTAL COST ANALYSIS (WETLANDS FUNCTIONAL ASSESSMENT)

Alternative Plan	Functional Score (Points)	Annual Costs	Average Cost ($/ Point)	Incre-mental Cost	Incre-mental Functional Score (Points)	Incremental Cost Per Unit ($/ Point)
"No Action"	0	0	N/A	0	0	N/A
First "Best Buy" Plan: Grandy Village	166.70	$66,600	$400	$66,600	166.70	$400
Second "Best Buy" Plan: (All the Above) + NW Jordan Bridge	198.31	$82,400	$416	$15,800	31.61	$500
Third "Best Buy" Plan: (All the Above) + Carolanne Farms	230.85	$100,100	$434	$17,700	32.54	$544
Fourth "Best Buy" Plan: (All the Above) + ODU Drainage Canal	249.61	$112,000	$449	$11,900	18.76	$634
Fifth "Best Buy" Plan: (All the Above) + Woodstock Park	297.85	$143,800	$483	$31,800	48.24	$659
Sixth "Best Buy" Plan: (All the Above) + Crawford Bay	333.52	$167,400	$502	$23,600	35.67	$662
Seventh "Best Buy" Plan: (All the Above) + Scuffletown Creek	340.44	$172,300	$506	$4,900	6.92	$708
Eighth "Best Buy" Plan: (All the Above) + Lancelot Drive	473.69	$276,600	$584	$104,300	133.25	$783
Ninth "Best Buy" Plan: (All the Above) + Portsmouth City Park	497.21	$299,500	$602	$22,900	23.52	$974
Tenth "Best Buy" Plan: (All the Above) + Sugar Hill	504.27	$306,900	$609	$7,400	7.06	$1,048
Eleventh "Best Buy" Plan: (All the Above) + Somme Ave	519.02	$325,900	$628	$19,000	14.75	$1,288

As evident from Tables 25 and 26 and Figures 31 and 32, the two methodologies for assessing benefits from the alternative wetlands restoration sites produce a slightly different ordering or ranking for the implementation of sites. However, there are clear patterns to the ordering of sites under both the habitat assessment and wetlands functional assessment methods. For example, NW Jordan Bridge, Grandy Village, and Carolanne Farms emerge as the top three sites under both methods. If the decision is made to invest a total (annual cost) of $100,100 in those three sites, the next grouping of sites in increasing rank (and increasing incremental costs) is Scuffletown Creek, Crawford Bay, Woodstock Park, and ODU Drainage Canal, which rank fourth through seventh under both benefit methodologies. If a decision is reached to invest a total (annual cost) of $172,300 in the top seven sites (the top seven "Best Buy" plans), the next site to emerge is Lancelot Drive, which ranks eighth under both benefit methodologies. Again, if it is determined worthwhile to invest total annual costs of $276,600 in the top eight "Best Buy" plans, the final grouping of sites is Portsmouth City Park, Sugar Hill, and Somme Avenue, ranked ninth, tenth, and eleventh, respectively under the wetlands functional methodology, and tenth, ninth, and eleventh, respectively under the habitat assessment methodology. These are the ninth, tenth, and eleventh "Best Buy" plans. The rankings of "Best Buy" plans as just discussed are listed in the following table.

Table 27. RANKING OF "BEST BUY" PLANS BY BENEFIT ASSESSMENT METHODOLOGY

"Best Buy" Plan	Habitat Assessment Method	Wetlands Functional Assessment Method
1	NW Jordan Bridge	Grandy Village
2	*Above, plus* Grandy Village	*Above, plus* NW Jordan Bridge
3	*Above, plus* Carolanne Farms	*Above, plus* Carolanne Farms
4	*Above, plus* Scuffletown Creek	*Above, plus* ODU Drainage Canal
5	*Above, plus* Crawford Bay	*Above, plus* Woodstock Park
6	*Above, plus* Woodstock Park	*Above, plus* Crawford Bay
7	*Above, plus* ODU Drainage Canal	*Above, plus* Scuffletown Creek
8	*Above, plus* Lancelot Drive	*Above, plus* Lancelot Drive
9	*Above, plus* Sugar Hill	*Above, plus* Portsmouth City Park
10	*Above, plus* Portsmouth City Park	*Above, plus* Sugar Hill
11	*Above, plus* Somme Avenue	*Above, plus* Somme Avenue

Summary

The results of cost effectiveness and incremental cost analyses indicate that there are between 80 and 106 cost effective alternative wetland restoration plans, depending on which benefits assessment methodology is employed. Under both output assessment methods, there are 11 "Best Buy" plans, which, as plans increase in output, ultimately include all wetlands restoration sites. However, the ordering of the implementation of wetlands restoration sites differs somewhat between methods. Figures 31 and 32 show definite breakpoints as the incremental cost curve is climbed. These relatively large incremental jumps, for example, between Lancelot Drive and Sugar Hill on the habitat assessment incremental cost graph, or between Sugar Hill and Somme Avenue on the wetlands functional assessment incremental cost graph, may offer a logical point at which to ask whether the next increment of output is worth the investment to achieve it.

The results of the cost effectiveness and incremental cost analyses indicate that there are two "Best Buy" plans for sediment remediation. These are the 0.6 ERM SQV plan and the 0.4 ERM SQV plan. However, there is a significant breakpoint after the 0.6 ERM SQV plan. Incremental costs per unit of output more than triple from the first "Best Buy" plan (0.6 ERM SQV) to the second "Best Buy" plan (0.4 ERM SQV).

X. RECREATION BENEFIT ANALYSIS

The proposed project contains several recreation features that meet the criteria for recreation development at ecosystem restoration projects, as described in Appendix B, EP 1165-2-502. Recreation features at the proposed wetland restoration sites of Portsmouth City Park and Grandy Village were evaluated. The complete analysis is contained in Appendix C.

Benefits arising from recreation opportunities created by a project are measured in terms of willingness to pay. Economic Guidance memorandum 01-01 (Unit Day Values for Recreation, Fiscal Year 2001), dated 1 November 2000, was used to assign values to recreation. The 1996 Virginia Outdoors Plan was utilized to assess demand for recreation and the Hampton Roads Planning District Commission was contacted to discuss data sources used to facilitate this analysis.

WITHOUT PROJECT CONDITION

As prescribed in the IWR Planning Manual (IWR Report 96-R-21, dated November 1996), proper project without project condition analysis includes a comprehensive, rational, alternative future oriented, honest, and inclusive evaluation. The without project conditions at Portsmouth City Park and Grandy Village differ greatly. Portsmouth City Park offers tennis courts, walking areas, a public golf course, boat ramp, and open areas. Grandy Village currently offers none of these general recreation features.

As regards the future, the requirements contained in ER 1105-2-100 (Planning Guidance Notebook, 22 April 2000) are that a reasonable effort be made to identify future without project conditions. Grandy Village is a multi-family residential housing complex currently experiencing an urban renewal. For example, Housing and Urban Development (HUD) funds are being used to renovate and replace the aging housing stock.

Portsmouth City Park receives approximately 250,000 annual visitation (visitor days) as general recreation (trip purpose). Grandy Village is not currently used for recreational purposes and there are no specialized recreational uses of either site.

The unit day value (UDV) methodology was selected as the value of recreational use. The UDV method for estimating recreation benefits relies on expert or informed opinion and judgment to approximate the average "willingness-to-pay" of users of Federal or Federally assisted recreation resources. If it can be demonstrated that more reliable travel cost method (TCM) or contingent valuation method (CVM) estimates are either not feasible or not justified for the particular project under study, the UDV method may be used. By applying a carefully thought-out and adjusted UDV to estimated use, an approximation is obtained that may be used as an estimate of project recreation benefits. When the UDV method is used for economic evaluations, planners will select a specific value from the range of values provided annually. Application of the selected value to estimated annual use over the project life, in the context of the with- and without project framework of analysis, provides the estimate of recreation benefits. In that connection, table 1 from EGM 01-01 was utilized to assign points for general recreation. Three experienced planners evaluated the five criteria of recreation: experience, availability of opportunity, carrying capacity, accessibility, and environmental. The result of this evaluation for Portsmouth City Park was a point value of 29.9, and for Grandy Village a point value of 4.6.

These point values were then related to the point value ranges contained in EGM 01-01 to arrive at UDV for recreation under the without project condition. The resulting UDVs are $4.18 per visitor day at Portsmouth City Park and $3.06 per visitor day at

Grandy Village. Multiplying the visitation estimates for Portsmouth City Park by the UDV yields an annual recreation value of $1,045,000. Because there is no existing recreational use of the Grandy Village site, there are no existing recreation benefits.

WITH PROJECT CONDITION

A similar analysis was made for the with project condition at each site. Recreational use under the with project condition does not change for Portsmouth City Park. The with project condition at Grandy Village offers general recreational opportunities such as walking areas and open areas. Similarly, the with project visitation (visitor days) by recreational experience (trip purpose) does not change for Portsmouth City Park. As derived from the 1996 Virginia Outdoors Plan, the with project recreational use of Grandy Village is 10,290 annual recreational use (visitor days).

As with the without project condition, point values were assigned to the with project condition. The point value for Portsmouth City Park is 37.4 and for Grandy Village the point values is 28.

These point values were then related to the point value ranges from EGM 01-01 to arrive at UDV for recreation under the with project condition. The resulting UDVs are $5.01 per visitor day at Portsmouth City Park and $4.12 per visitor day at Grandy Village. Multiplying the visitation estimates for Portsmouth City Park by the UDV yields an annual recreation value of $1,252,500. Multiplying the visitation estimates for Grandy Village by the UDVs yields an annual recreation value of $42,400.

Adequate support facilities are in place to support the projected visitation.

AVERAGE ANNUAL BENEFITS

The measure of annual benefits is the difference between benefits in the with and without project condition. Average annual benefits are thus $249,900 as shown in table 28.

Table 28. AVERAGE ANNUAL BENEFITS - RECREATION

Item	Portsmouth City Park	Grandy Village
With Project Condition	$1,252,500	$42,400
Without Project Condition	$1,045,000	0
Average Annual Benefit	$207,500	$42,400
TOTAL AVERAGE ANNUAL BENEFITS	$249,900	

XI. ENVIRONMENTAL IMPACT EVALUATION

Generally, the environmental impacts to water quality, wetlands, forested uplands and other adjoining habitats are minimal compared to the environmental benefits that would be realized with construction of the alternative plans under evaluation. The following narrative is a brief discussion of project impacts, and a more comprehensive discussion is presented in the accompanying Draft Environmental Assessment.

THREATENED AND ENDANGERED SPECIES

Informal consultation with the USFWS and the National Marine Fisheries Service (NMFS) has been initiated requesting information for listed or proposed endangered or threatened species and designated or proposed critical habitats in the project study area. NMFS indicated that there are no known resources in the project area subject to NMFS purview and that further Endangered Species Act (ESA) consultation with NMFS is not necessary. The USFWS indicated that the recommended project is not likely to affect federally listed or proposed species.

WATER QUALITY

Temporary water quality impacts are expected with all construction alternatives due to activities themselves, which would include dredging associated with removal of contaminated bottom sediments, excavation of fill materials from previously filled wetland areas, and placement of fill material in open water to create wetland bench for intertidal wetland development. Impacts anticipated would include increased suspended sediments and turbidity. Suspended sediments and turbidity have the potential to decrease the concentration of dissolved oxygen and water clarity. This would be a temporary effect during construction.

Long term benefits to water quality would be realized with sediment clean-up and wetland restoration. Wetlands act as natural filtering and buffering systems for stormwater and other non-point discharges into the river. They also act to stabilize the shoreline, preventing erosion and sediment input. Sediment clean-up should result in reduced contaminants being released to the water column as these bottom sediments are resuspended by natural phenomena and man-induced activities.

ESSENTIAL FISH HABITAT (EFH)

The National Marine Fisheries Service (NMFS) has indicated by letter dated June 7, 2001 that, "...the proposed dredging of contaminated sediments could adversely impact juvenile fish, including anadromous fish species...Pursuant to Section 305(b)(4)(9A) of the MSFCMA, we offer the following Conservation Recommendation: that no dredging take place from February 15 through June 30, to reduce any potential adverse impacts from the proposal".

The NMFS conclusion that the proposed dredging would adversely affect Essential Fish Habitat (EFH) is not substantiated. The proposed dredging will take place in a secluded creek off the main stem of the river and will be performed with equipment and in such a manner that suspended sediment in the water column will be minimized and retained within a relatively isolated area. EFH will be positively and beneficially affected by reducing bottom sediment toxicity, improving benthic community abundance and diversity, and reducing the existing incident of fish cancers, lesions, and abnormalities.

Removing contaminated sediments from Scuffletown Creek will enhance fisheries habitat by reducing physiological stress and increasing numbers of benthic organisms, many of which are food sources for fish found in the area, such as spot, summer flounder, windowpane flounder, and anadromous fish species. Restoring the wetland sites should also provide positive benefits to EFH by enhancing water quality and providing additional food, spawning, and nursery areas for fishes in the area. Therefore, based upon the conclusion of the accompanying EA that EFH would not be adversely affected, the conservation recommendation that no dredging take place from February 15 through June 30 will not be enforced.

HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE (HTRW)

The Norfolk District, Geoenvironmental Engineering Section, performed wetlands subsurface investigations to evaluate HTRW potential of 6 of 14 candidate wetland restoration sites. These six sites were selected because they are sites where excavation of fill materials will be required for restoration of the site. Six sites were not evaluated for subsurface HTRW potential because they will require no excavation (planting and/or filling only); one site (Lancelot Drive) was not performed because of low HTRW potential based on historical use of site; and HTRW field investigations were not performed at the final site (Scuffletown Creek) because this site was not identified until after the subsurface investigations were completed.

The results of these investigations are included in the Engineering and Cost Data, Appendix A, Attachment C. No RCRA hazardous wastes were encountered at any of the wetland restoration sites that were evaluated.

For sediment restoration, USACE Implementation Guidance dated 25 April 2001, Environmental Dredging (Section 312 of WRDA 1990, as amended by Section 205 WRDA 1996 and Section 224 of WRDA 1999), provides for removal of contaminated sediments outside the boundaries of and adjacent to a Federal navigation project as part of the operation and maintenance of the project (part a); or for the removal of contaminated sediments for the purpose of environmental enhancement and water quality improvement if such removal was requested by a non-Federal sponsor and the sponsor agreed to pay 35 percent of the cost of removal and 35 percent of the cost of disposal (part b).

Paragraph 3 of the Implementation Guidance states that "...As a matter of policy, where Section 312 authority is used to remove or remediate contaminated sediments complying with the definition of hazardous substance in the Comprehensive Environmental Response, Compensation, and Liability Act 42 U.S.C 9601 et seq (CERCLA), such removal or remedial action shall not be undertaken unless the Corps obtains reasonable protection from liabilities which may arise as the result of the removal or remediation." The site of sediment remediation investigation during this feasibility study, Scuffletown Creek, is not within the boundaries of a site designated by EPA or a state for a response action under CERCLA, and it is not part of NPL site under CERCLA. The appropriate "reasonable protection from liabilites" would be secured prior to construction.

While the sediments within Scuffletown Creek are contaminated and pose a threat to aquatic organisms in the river, they are not HTRW by CERCLA definition.

DEQ was requested to conduct a search of solid waste, hazardous waste, the U.S Environmental Protection Agency (EPA) CERCLIS (Superfund) List, and current investigation data files to provide any information available on HTRWs in the project areas. The real estate records furnished by DEQ indicate no incident of HTRW handlers or sites in the immediate area(s) of the proposed projects.

The findings from the DEQ Underground Storage Tank (UST) Program (investigations on location and condition of underground storage tanks) in the proposed project areas show that there are no active registered UST's in the proposed wetland or sediment restoration sites.

IMPACT ASSESSMENT OF THE ALTERNATIVES

Wetlands Restoration

There will be some conversion of upland and high marsh, predominated by common reed, to low marsh areas *(Spartina)* with restoration to historical wetland conditions. Three of the proposed wetland restoration sites will be converted from shallow water areas to emergent wetlands. Two of these shallow water_sites currently receive high volumes of storm water effluent and associated sediments. Build up of these sediments is evident and sediment quality is expected to be degraded in these areas. Table 29 provides information on the environmental impacts to adjacent habitat of the various wetland restoration alternatives.

The existing, unrestored, sites do provide some ecological benefits. The existing or base condition outputs are compared to the restored outputs in the benefits analysis portion of this document. As discussed in this section, the impacts related to conversion of one degraded habitat type to intertidal wetland would be out weighed by the benefits which functioning wetlands typically provide. Benefits to fish and wildlife habitat, primary production, water quality, erosion and flood buffer, aesthetics, and public accessibility and education would be greatly enhanced with the restoration/creation of wetlands at these sites.

Sediment Clean-Up (Environmental Dredging)

Dredging (environmentally) pertains primarily to removal of contaminated sediments by dredging with equipment that will minimize turbidity and the re-suspension of contaminated sediments. However, dredging in Scuffletown Creek may be associated with some undesirable short-term environmental effects. These are: short-term localized increases in turbidity and slight decreases in dissolved oxygen, direct loss of benthic organisms in the dredging area, and possible release of contaminants from the sediments to the water column.

Table 29. ELIZABETH RIVER WETLAND RESTORATION IMPACTS

Site	City	Impacts
1. Scuffletown Creek	Chesapeake	Grading and removal of upland fill material from historical wetland; some high marsh areas (saltbush and common reed) will be converted to emergent marsh areas (Spartina sp.)
2. East of Chesterfield Heights (Grandy Village)	Norfolk	Grading and removal of upland fill material from historical wetland; some high marsh areas (*Phragmites* sp. - common reed) will be converted to emergent marsh areas (Spartina sp.)
3. West of Old Dominion University (ODU Drainage Canal)	Norfolk	Conversion of approx. 1.2 ac of intertidal and shallow water habitat to 1.2 ac of Spartina sp. Marsh; area degraded due to high stormwater sediment input
4. Portsmouth City Park	Portsmouth	Grading and removal of upland fill material from historical wetland; minor conversion of emergent marsh to shallow tidal gut (500 square feet) to provide tidal exchange to restored marsh
5. Northwest side Jordan Bridge	Portsmouth	Conversion of approx. 1.2 ac of intertidal and shallow water habitat to 1.2 ac of Spartina sp. Marsh; area degraded due to high stormwater sediment input
6. Woodstock Neighborhood Park	Virginia Beach	Conversion of approx. 1.6 ac of shallow water habitat in man-made borrow pit to 1.6 ac of Spartina sp. marsh
7. I-64 Crossing of E. Branch (Lancelot Drive/Avalon Hills)	Virginia Beach	Grading and removal of (dredged) fill material from historical wetland; some higher marsh species (common reed) will be converted to emergent marsh species (Spartina sp.)
8. Carolanne Farm Park	Virginia Beach	Grading and removal of upland fill material; minor conversion of emergent marsh to shallow tidal gut (250 square feet) to provide tidal exchange to restored marsh

Dredging equipment and construction methods, which minimize these effects will be implemented. For example, the use of a closed bucket clamshell in some areas of the creek, as well as restrictions on the dredging operation could help to reduce adverse environmental effects caused by the dredging.

Applicable water quality controls, dredging operation controls, and/or environmental controls may be placed on the dredging operation to limit adverse impacts of this sediment removal action. Water quality controls may include placing limits on the amount of turbidity or increased concentrations of PAHs or other contaminants allowed in the water column outside the immediate dredging area. Dredge operation controls might include limiting the bucket cycle time, prohibiting nighttime dredging operations, and requiring buckets and scows not to be overfilled (i.e., no overflow).

As discussed in the benefits analysis portion of this document (Plan Formulation), these short term and temporary impacts would be outweighed by long-term restoration benefits to fisheries, bottom (benthic) communities, and sediment toxicity reduction related to contaminated sediment removal.

REAL ESTATE IMPACTS

The effect of various wetland and sediment restoration alternatives was investigated for their impact on the acquisition of real estate to support the restoration alternative. No structures would be acquired for the various wetland or sediment restoration alternatives, however some land areas will be needed to construct the wetland sites. Construction easements will be required for access. Wetland sites were initially screened and selected because most are on public lands. Some privately held subaqueous (i.e., below MLW) land will have to be acquired at several sites.

SOCIAL IMPACTS

All the plans considered in this study would have minimal social impacts on the adjoining communities. There would be some minor disruptions during construction but there would be an overall improvement in the communities affected. An overview of the impacts is shown in the following table.

Table 30. SOCIAL IMPACTS/EFFECTS OF THE ALTERNATIVES

Environmental Dredging	Wetland Restoration
• Minor/temporary disruption during construction • Reduced human health risk • Improved aesthetics • Improved community perception • Improved recreational & commercial fishing	• Minor/temporary disruption during construction • Increased natural areas • Increased "greenspace" • Recreation potential • Visual changes • Educational value enhanced

CULTURAL RESOURCE IMPACTS

The NER plan which includes both sediment clean-up and wetlands restoration has been coordinated both formally and informally with the Virginia Department of Historic Resources (DHR) during the course of this feasibility study. Norfolk District personnel met with DHR in July 1999 to update the agency on the study's progress.

Wetland Restoration

The background research for project effects on historic properties suggests that there are three categories of locations. Background research indicates that some locations clearly have very low or no potential for containing historic properties, or affecting them. For these sites, no further work is recommended. A second category of locations includes those sites that may have some potential for containing historic properties, but project effects may depend on the specific design of the restoration project. An examination of detailed project plans for these sites is recommended to determine whether or not field investigations are justified. The third category of locations includes those that have a high potential for containing historic properties, in this case, archaeological sites. Inventory level survey is recommended for these, if they are selected as restoration sites.

The project locations are grouped as follows:

No Further Work Recommended:

1. ODU Drainage Canal, Norfolk;
2. Crawford Bay, Portsmouth.

Review Detailed Project Plans for Potential Effect:

3. Somme Avenue, Norfolk;
4. Scuffletown Creek, Chesapeake;
5. Western Branch Park, Chesapeake;
6. Grandy Village, Norfolk;
7. Portsmouth City Park, Portsmouth;
8. Jordan Bridge, Portsmouth;
9. Scott's Creek (Sugar Hill), Portsmouth;
10. Lancelot Drive, Virginia Beach;
11. Woodstock Park, Virginia Beach.

Inventory Survey Recommended:

12. Carolanne Farms Park, Virginia Beach.

As with any construction activity that results in a disturbance of the soil, construction of any of the alternatives being considered has the possibility of discovering new archaeological or historical resources. However, the failure to discover any resources during the previous fieldwork reduces the probability of finding any significant resources inadvertently during construction.

No specific costs for data recovery are included because, at this point, it is unknown if any data recovery will be required. Field investigations will be carried out for at least one site in the next phase of the study, and the results of this investigation will determine whether any data recovery will be necessary. Construction costs include a contingency intended to cover potential data recovery requirements.

Sediment Remediation

No adverse effect to cultural or historical resources is anticipated with dredging or related clean-up activities in Scuffletown Creek.

XII. THE NATIONAL ECOSYSTEM RESTORATION (NER) PLAN

FEDERAL INTEREST

For ecosystem restoration projects, the NER plan is defined as the plan that reasonably maximizes ecosystem restoration outputs and associated benefits compared to costs, consistent with the Federal objective. The selected plan must be shown to be cost effective and justified to achieve the desired level of output. The NER plan meets planning objectives and constraints and reasonably maximizes environmental benefits while passing tests of cost effectiveness and incremental cost analysis, significance of outputs, acceptability, completeness, efficiency, and effectiveness.

The NER plan for the Elizabeth River contains two components: sediment clean-up and wetlands restoration.

SEDIMENT CLEAN-UP COMPONENT OF THE NER PLAN

The sediment clean-up component of the NER plan has been developed consistent with Section 312 of WRDA 1990, as amended, and CECW Implementation Guidance dated 25 April 2001, Environmental Dredging. Section 312(b) provides for removal of contaminated sediments for the purpose of environmental enhancement and water quality improvement if such removal is requested by a non-Federal sponsor and the sponsor agrees to pay 35 percent of the cost of removal and 35 percent of the cost of disposal (as amended by Section 224 of WRDA 1999).

The sediment clean-up component of the NER plan is to achieve a medium level of clean-up in Scuffletown Creek. This is equivalent to a SQV of 0.6. While all three levels of clean-up (minimum, medium, and maximum) are cost effective, incremental cost analysis indicates that the medium clean-up level is the first "Best Buy" plan. It has the lowest cost per unit of clean-up benefit of any of the alternative plans. The medium level of clean-up will provide substantial restoration benefits (reduced toxicity, reduced gross sediment contamination, improved bottom community health and related fish and wildlife benefits) as compared to the without condition. This being the first sediment clean-up project in the Elizabeth River, it is realistic to achieve and sustain this level of clean-up. As this and additional sediment clean-up projects are completed at other locations in the river, higher levels of clean-up in the Elizabeth River will be achievable and sustainable.

The Recommended Plan (clean-up to a SQV of 0.6) would have the following components: dredging of the contaminated bottom sediments; transport of the sediments by truck or barge to a staging area or dredged material placement site; at the staging area, treatment; and then treated material to a final disposal site (solid waste landfill). Finally, monitoring of the dredged (cleaned) site.

Dredging would need to be accomplished in a manner that would minimize turbidity and re-suspension of sediments and associated contaminants. Applicable water quality controls, dredging operation controls, and/or environmental controls would be placed on the dredging operation to limit adverse impacts of this sediment removal action. Water quality controls include placing limits on the amount of turbidity or concentrations of PAHs/metals or other contaminants allowed in the water column outside the immediate dredging area. Dredging operation controls include limiting the bucket cycle time, prohibiting nighttime dredging operations, and not allowing scows to be overfilled. Other environmental controls may be used around the dredging operation. In addition, watertight scows or trucks are recommended for transporting sediments.

The staging area for the transfer/dewater and treatment operation would be located either at the Craney Island Dredged Material Management Area (CIDMMA) or the Higgerson Buchanan dredged material placement area.

Transportation of the treated sediments would be delivered by truck to the final disposal site. This transportation would be conducted in accordance with regulations pertaining to the transport of solid waste, as appropriate.

Design environmental protection measures would be incorporated into the project design, construction, operation, and maintenance of the staging areas as well as the final disposal site. A project health and safety plan will be prepared for project implementation with project plans and specifications.

Dredging, transfer/dewatering, treatment, and disposal of sediment would take place over a three to six month period. Dredging would likely occur from upstream to downstream, in order to try to recapture any resuspended sediments and associated particulates.

WETLAND RESTORATION COMPONENT OF THE NER PLAN

The wetland restoration component of the NER plan is to restore eight of eleven sites that were evaluated through cost effectiveness and incremental cost analysis. During the feasibility investigations, eight other candidate wetland sites had previously been screened out for various reasons not related to cost or benefit. Wetlands provide enormous functional value and when wetlands are lost or degraded, these functional values are lost as well. The substantial loss of wetlands in this river system (over 50% since World War II) has contributed to the river's degradation and diminished its value to fish and wildlife resources. The combination of these eight sites, distributed over most of the river basin, will add ecological benefits over a broad geographic area. This broad approach is consistent with the Federal objective to "...accomplish a return of natural areas or <u>ecosystems</u> to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions". (ER 1105-2-100, E-30(a)). Similarly, ER 1105-2-100, paragraphs 3-5 state that "...Ecosystem restoration projects should be formulated in a systems context to improve the potential for long-term survival of aquatic, wetland, and terrestrial complexes as self-regulating, functioning systems".

Restoration of these eight sites will provide over 18 acres of restored wetland and buffer habitat contributing water quality improvements, fish and wildlife habitat, erosion reduction, flood buffering, aesthetic improvement and education and recreation benefits.

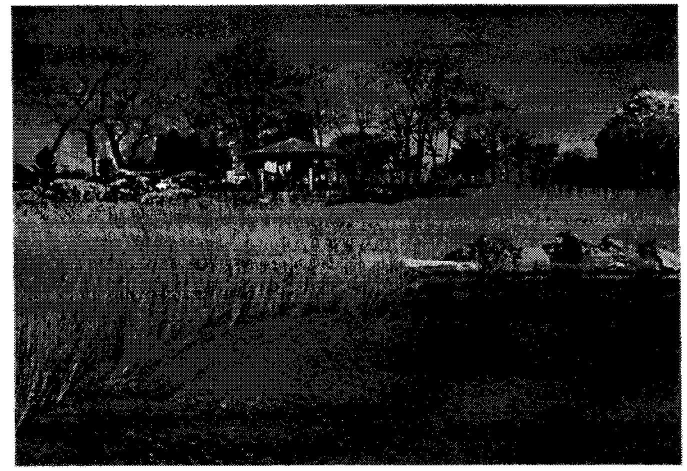
Three sites are not recommended for construction that were evaluated for cost effectiveness. For the proposed Crawford Bay restoration site, two civic groups expressed major objections to the proposed wetland restoration near their neighborhood. While this group was supportive of the need for improving the environmental quality of the Elizabeth River, they were very adamant that this project was not going to "take place in their backyards". The concerns expressed were centered on perceived impacts on property values, debris accumulation, aesthetics, and storm water drainage. These objections ultimately led to the removal of the Crawford Bay site from further consideration in this study. This decision received the concurrence of the Corps/Sponsor Steering Committee.

Three sites, Sugar Hill, Somme Avenue, and Portsmouth City Park fall at a break point on the incremental cost curve where a relatively large incremental jump in costs is required in order to achieve a relatively small incremental benefit. Incremental costs jump (Functional Assessment and HEP)- as you move from the 8th "Best Buy" Plan (Lancelot Drive) to the 9-11th "Best Buy" Plans (Sugar Hill, Somme Avenue, and Portsmouth City Park). For Somme Avenue, it was not determined to be "worth it" when considering both cost and benefit, logistical constraints, and the relatively small size of the site as related to cost. Subsequent to this analysis, it was learned that Sugar Hill is being pursued by the Virginia Department of Transportation (VDOT) as a mitigation site and is no longer under consideration as part of this study initiative. It was decided by the Steering Committee, however, to retain Portsmouth City Park as part of the wetland component of the NER plan. The reasons for retaining this wetland site include the following:

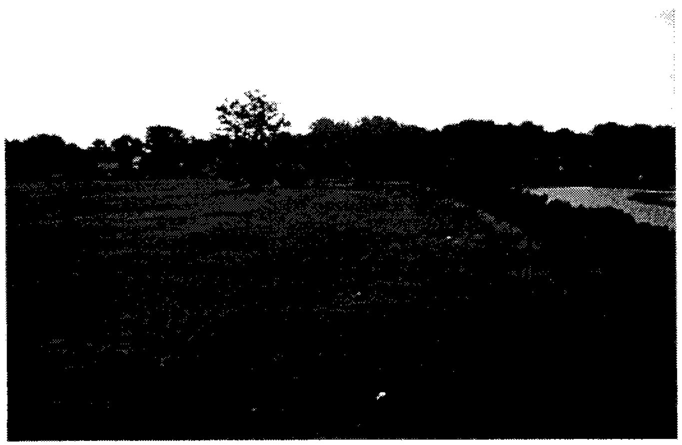
1. Portsmouth City Park is the only site on the Western Branch of the Elizabeth River (speaks to "completeness" of the NER plan).
2. The sponsor (City of Portsmouth) strongly endorses the restoration of this site (views of the non-Federal sponsor and acceptability).
3. Restoration of the site is an integral part of the sponsor's long range plan for the park.
4. As a city park, the restoration project is highly visible, and would provide educational opportunities for numerous visitors.

Photo enhancements showing the before and (proposed) after-project conditions at several of the recommended wetland restoration sites are displayed in the following photographs.

Portsmouth City Park - Before



Portsmouth City Park - After (as proposed)



Woodstock Park - Before

Woodstock Park - After (as proposed)

WETLAND RESTORATION PHOTO ENHANCEMENTS

Jordan Bridge - Before

Jordan Bridge - After (as proposed)

Scuffletown Creek - Before

Scuffletown Creek - After (as proposed)

WETLAND RESTORATION PHOTO ENHANCEMENTS

ODU Drainage Canal - Before

ODU Drainage Canal - After (as proposed)

Grandy Village - Before

Grandy Village - After (as proposed)

Table 31. WETLANDS RESTORATION COMPONENT OF THE NER PLAN

Site	City	Acres Restored
1. Scuffletown Creek	Chesapeake	0.33
2. East of Chesterfield Heights (Grandy Village)	Norfolk	7.0
3. West of Old Dominion University (ODU Drainage Canal)	Norfolk	0.6
4. Portsmouth City Park	Portsmouth	.85
5. Northwest side Jordan Bridge	Portsmouth	1.2
6. Woodstock Neighborhood Park	Virginia Beach	1.6
7. I-64 Crossing of E. Branch (Lancelot Drive/Avalon Hills)	Virginia Beach	5.4
8. Carolanne Farm Park	Virginia Beach	1.22
TOTAL		18.2

NER PLAN EVALUATION

"Is it worth it?"

The projects presented in the recommended plan are worth the cost because they will restore a significant ecological resource that is scarce in this river basin and because they are supported by the non-Federal sponsors. The recommended plan is acceptable, efficient (cost effective), and complete. The widely recognized degraded condition of the Elizabeth River has put it in the national spotlight. Because it is a highly developed urban watershed, there are very limited opportunities to restore this river to a measure of its historical conditions. The enormous community and political support, and the identification of feasible restoration projects that will provide tangible environmental quality benefits, all underscore the importance and urgency of pursuing these projects now.

Significance

The importance of the resources in the Elizabeth River has been recognized by national agreements such as the Chesapeake Bay Agreement and the Library of Congress's Local Legacies program. The river has received broad public recognition as one of three "Regions of Concern" in the Chesapeake Bay watershed. The Chesapeake Bay Agreement 2000 focuses on the Elizabeth as a priority urban area for restoration. The Elizabeth River Project, a grassroots organization with over 400 citizen, industry, and government members has developed a "Watershed Action Plan" to restore the river to its highest practical level. The problems and needs in the river have been clearly demonstrated in scientific and technical studies and in published scientific journals and literature.

Scarcity

Greater than 50% of tidal wetlands were lost in the Elizabeth River between 1944 and 1977 (Priest, 1999). During this period, the rate of loss was over 100 acres per year for a total loss of tidal wetlands of over 3400 acres. Most of these, now developed military bases, industrial and commercial sites, and residential areas, can never be restored to their historical conditions. There are very few remaining "available" sites to restore in this highly developed urban watershed therefore, it is critical to restore these few available sites if any increment of river restoration is to be accomplished.

Bottom dwelling organisms, used extensively as indicators of estuarine environmental status and trends, are seriously degraded in the Elizabeth River. Low species diversity and biomass, and few pollution sensitive species are directly related to the toxic nature of the river's bottom sediments. In the Southern Branch, 92 percent of the fish exhibited precancerous liver lesions and 38 percent showed cancerous lesions. In shoal "hot spots" in the Southern Branch, VIMS found levels of PAHs – polycyclic aromatic hydrocarbons, correlated with cancer – at up to 463 times the concentrations in the Chesapeake Bay and 18 times higher than in Baltimore Harbor. These degraded conditions have led to a scarcity of aquatic life in the river.

Acceptability

Sediment clean-up and wetlands restoration have been endorsed by the Elizabeth River Project (ERP), as the number one and number two "critical areas" deserving the highest priority attention in ERP's Watershed Action Plan. This Plan was developed by a 120-member Watershed Action Team representing state and Federal resources agencies, businesses, academia, and citizens. The Plan was presented to the public in 1996 and received wide support and endorsement. The Watershed Action Team is a diverse group representing a variety of concerns and interests.

Views of the Non-Federal Sponsor

The recommended plan has been developed over the course of three years by a Steering Committee comprised of the five non-Federal cost sharing sponsors, the COE, the Elizabeth River Project and other local and governmental representatives. The monthly meetings of this committee have provided many opportunities for input, discussion, and endorsement as the plans have evolved through the reconnaissance and feasibility study processes. The recommended plan which has developed over this time is acceptable to and enthusiastically supported by all five cost sharing sponsors and the Elizabeth River Project. There are wetland restoration projects located in each of the four cities, lending local political and community acceptance to the plan. Sediment clean-up is recognized as the "bottom line," without which the river cannot begin to fully recover. Because the Elizabeth River is a spawning and nursery habitat for many aquatic species, sediment clean-up will have far reaching effects throughout the river system (and over all political boundaries), the Chesapeake Bay and beyond.

Effectiveness

The recommended plan is effective because it addresses the two greatest problems and needs in the Elizabeth River: wetlands loss and sediment contamination. The restoration projects and associated benefits that the plan will provide are spread over a large geographic area in the Elizabeth River system. The projects have been designed to have an interconnectedness with components of the natural systems in the Elizabeth River.

Efficiency

The recommended plan passes tests of cost effectiveness and incremental cost analyses (CE/ICA). As shown through the preceding section on CE/ICA, the eight wetlands sites represent a cost effective means of restoring 18.2 acres of wetlands – no other plan yields the same level of wetlands for less cost. The recommended plan is also a "Best Buy" plan, incorporating eight wetlands restoration sites. Using the wetlands functional assessment methodology, it is has the lowest incremental costs per unit of output to achieve 18.2 acres of wetlands restoration. These restoration outputs and associated benefits could not be produced more efficiently by another agency or institution.

The medium level clean-up alternative (equivalent to a SQV of 0.6) is cost effective. Furthermore, as a "Best Buy" plan, it is incrementally justified. The medium level plan has the lowest costs per functional score clean-up point of any of the sediment restoration alternatives. These restoration outputs and associated benefits could not be produced more efficiently by another agency or institution.

AVERAGE ANNUAL COST SUMMARY

Table 32 displays average annual cost summaries for the recommended NER plan, including eight wetland restoration sites and sediment clean-up at 0-6 foot depth increment.

Interest During Construction

Interest During Construction (IDC) for the selected wetland sites is estimated to be $135,000, based upon a construction period lasting 12 months and a 6-3/8 percent interest. For the Scuffletown Creek remediation, IDC costs for dredging to 0-6 feet is $246,000. Construction of all wetland sites and sediment clean-up is anticipated to occur in a 12-month period; based upon this, IDC was assumed to be proportional among all alternatives for plan formulation. Plan selection was, therefore, insensitive to this cost, and IDC was only included in the total cost of the recommended plan.

Table 32. EQUIVALENT ANNUAL COSTS AND BENEFITS
NER PLAN
(FY 2001 Price Level, 50-Year Period of Analysis,
6.375 Percent Discount Rate, Base Year 2003)

Total	Sediments[1]	Wetlands[2]
First Costs:		
First Costs	$8,530,000	$4,660,000
Interest During Construction	$246,000	$135,000
Total Investment Cost	$8,776,000	$4,795,000
Annual Costs:		
Interest and Amortization of Initial Investment	$586,200	$319,850
OMRR&R (average)	$4,000	$1,150
Total Average Annual Cost	$590,200	$321,000
Annual Restoration Benefits:		
Wetlands, as:	(wetland habitat)	18 acres
	(wetland habitat units)	14 AAHU's
	(functional score)	462
	(riparian buffer)	3 acres
	(tidal creek area)	1 acre
Annual Restoration Benefits:		
Sediments, as:	(functional score)	7.84
Annual Recreation Costs (Wetlands):		$27,000
Annual Recreation Benefits (Wetlands):		$250,000

[1]Upon the approval by the ASA (CW), the sediment restoration work would be accomplished as authorized by Section 312 (b) of the Water Resources Development Act of 1990, as amended.
[2]Wetland restoration work would be accomplished as authorized by Section 206 of the Water Resources Development Act of 1996, as amended (Aquatic Ecosystem Restoration).

ECONOMIC IMPACTS

For the NER plan, the estimated investment (construction plus interest during construction (IDC)) for wetland restoration at the eight recommended sites is $4,795,000. The estimated investment for sediment removal, assuming a dredging depth of 0-6 feet is $8,776,000, and the combined total investment (sediment and wetland restoration) will be $13,571,000. Annual operation and maintenance for all eight wetland sites is estimated at $1,150; estimated annual maintenance costs for the Scuffletown Creek sediment site is $4,000. The total average annual maintenance for the project will be approximately $5,150.

The selected wetland sites are anticipated to provide average annual NER environmental outputs and associated benefits of 14.88 habitat units, or 497.21 functional units. At the recommended 0.6 ERM SQV, sediment removal and remediation will provide NER outputs (and associated benefits) through an average annual functional value of 7.84.

Table 33. TOTAL ECONOMIC COSTS – NER PLAN

NER Plan Component	Construction 1st Costs	IDC	Total Investment	Average Annual Maintenance Costs	Total Annual-ized Costs
Wetland Sites	$4,660,000	$135,000	$4,795,000	$1,150	$321,000
Sediment Remediation 0-6 Feet Dredging	$8,530,000	$246,000	$8,776,000	$4,000	$590,200
Project Total	**$13,190,000**	**$381,000**	**$13,571,000**	**$5,150**	**$911,200**

First costs of the project, including preconstruction, engineering and design and construction management are presented in the following table.

Table 34. FIRST COSTS
(FY 2001 Price Levels)

Work Item	Wetland Project ($)	Sediment Project ($)
Lands and Damages	46,000	10,000
Relocations[1]	0	0
Wetlands	3,660,000	0
Sediment		7,171,000[2]
Recreation Features	404,000	0
Preconstruction Engineering and Design	223,000	777,000
Construction Management	327,000	572,000
Section 206 Project Cost	4,660,000	
Section 312(b) Project Cost		8,530,000
ELIZABETH RIVER RESTORATION PROJECT COST $13,190,000[3]		

[1]Per Appendix B, page 6, relocations to be covered through project contingency
[2]Includes $60,000 for post-construction site monitoring
[3]Upon the approval by the ASA (CW), the $8,530,000 sediment restoration work would be accomplished as authorized by Section 312 (b) of the Water Resources Development Act of 1990, as amended. Wetland restoration work would be accomplished under the authority of Section 206 of WRDA 1996, as amended (Aquatic Ecosystem Restoration).

COST SHARING AND IMPLEMENTATION

Cost sharing for environmental dredging (sediment clean-up) is based on authority contained in Section 312 of WRDA 1990, as amended by Section 205 WRDA 1996 and Section 224 of WRDA 1999. The authority provides for removal of contaminated sediments outside the boundaries of and adjacent to a Federal navigation project as part of the operation and maintenance of the project (part a); or for the removal of contaminated sediments for the purpose of environmental enhancement and water quality improvement if such removal was requested by a non-Federal sponsor and the sponsor agreed to pay 35 percent of the cost of removal and 35 percent of the cost of disposal (part b).

Cost sharing for aquatic ecosystem restoration projects is specified in Section 206 of WRDA 1996, as amended. This would apply to the wetlands restoration component of the NER plan. The following apply to cost sharing under this authority:

1. The non-Federal share of the costs of aquatic ecosystem restoration projects shall be 35 percent. The non-Federal sponsor shall provide all lands, easements, rights-of-way, relocations and disposal areas (LERRD) required for the restoration project and shall also be responsible for 100 percent of the Operations, Maintenance, Replacement, Repair, and Rehabilitation (OMRR&R).
2. Credit for LERRD combined with in-kind services cannot exceed 35% non-Federal share of total project costs.

Also, under the provisions of the Section 206 authority, the entire non-Federal share of the total project cost may be credited work-in-kind.

Accordingly, the non-Federal share is 35 percent of the project or separable element implementation costs. Non-Federal sponsors are required to pay 100 percent of the lands, easements, rights-of-way, relocation and disposal (LERRD) but the value of the LERRD is included in the non-Federal 35 percent share.

For environmental dredging and wetlands restoration, the non-Federal sponsor is required to provide 100 percent of the operation, maintenance, rehabilitation, and replacement (OMRR&R). OMRR&R includes site monitoring which is cost shared the same as construction during the first five years as described below.

The NER plan has a (cost shared) total project construction cost of $13,190,000 with environmental dredging 0-6 feet. The annual cost of OMRR&R is estimated at $5,150. Tables 35 and 36 show the cost sharing distributions for each of the two components of the NER plan (wetland and sediment restoration).

Table 35. FEDERAL/NON-FEDERAL COST APPORTIONMENT
SECTION 206 WETLAND RESTORATION
($1,000s, FY 2001 Price Level)

WETLAND RESTORATION			
Item	Cost		
Preconstruction, Engineering & Design	223		
Construction Management	327		
Construction	4,064		
Real Estate	46		
Relocations	0		
TOTAL FIRST COSTS	**4,660**		
COST SHARING			
Item	Federal Cost	Non-Federal Cost	Total
RESTORATION FIRST COSTS (65% Federal/35% Non-Federal)	2,766	1,490	4,256
RECREATION FIRST COSTS[1] (50% Federal/50% Non-Federal)	202	202	404
TOTAL FIRST COSTS	**2,968**	**1,692**	**4,660**
Credit for LERRD[2]		-46	
TOTAL CASH APPORTIONMENT	**2,968**	**1,646**	

[1]ER 1105-2-100, paragraph 3-5.b(6) and Appendix E, paragraph E-47, limits cost shared recreation features to 10 percent of the Federal cost of the project with a cost sharing requirement of 50% for recreation features.
[2]Under Section 206 authority, credit for LERRDs combined with in-kind services cannot exceed 35% share of project costs

Table 36. FEDERAL/NON-FEDERAL COST APPORTIONMENT
SECTION 312(b) SEDIMENT CLEAN-UP
($1,000s, FY 2001 Price Level)

SEDIMENT CLEAN-UP	
Item	Cost
Preconstruction, Engineering & Design	777
Construction Management	572
Construction	7,171
Real Estate[1]	10
Relocations	0
TOTAL FIRST COSTS	**8,530**

COST SHARING			
Item	Federal Cost	Non-Federal Cost	Total
RESTORATION FIRST COSTS (65% Federal/35% Non-Federal)	5,544.5	2,985.5	8,530
TOTAL CASH APPORTIONMENT	**5,544.5**	**2,985.5**	

[1]Per CECW Section 312 Guidance memo dated 25 April 2001 paragraph (6)(b), all costs related to the disposal of contaminated sediment, including LERR, are shared as a cost of construction.

A variety of environmental restoration authorities are designed to be used for environmental restoration projects (Table 37). These include Section 1135 of WRDA 1986, as amended (project modifications for improvement of the environment), Section 206 of WRDA 1996 (aquatic ecosystem restoration), Section 204 of WRDA 1992 (ecosystem restoration in connection with dredging), and Section 510 of WRDA 1996 (Chesapeake Bay environmental restoration and protection program). Projects constructed under these authorities have a maximum federal cost of $5 million and the local sponsor's share of construction cost ranges from 25 to 35 percent. These authorities offer an avenue to expedite the construction of smaller projects recommended by this feasibility study by eliminating the specific congressional authorization and appropriation process. All authorities for environmental restoration have been explored during the feasibility study process in the interest of expediting all or portions of the recommended plans. The local sponsors have expressed an interest in pursuing the wetland restoration component of the NER plan under the authority of Section 206 of WRDA 1996, as amended.

As discussed above, the Federal government will pay 65 percent of the NER cost for the Federal portion of the project and the Non-Federal sponsor(s) will pay 35% of the cost. The non-Federal sponsors will provide the LERRD's required for project implementation but the non-Federal sponsor will be afforded credit against its share of project costs for the value of lands, easements, rights-of-way it provides, and the value of relocations it performs, that are required for the project as determined by the government.

Upon completion of the project, the ownership and operation and maintenance responsibilities for all restoration sites will be transferred to the non-Federal sponsors. For each wetland restoration project, the non-Federal sponsor is designated as that city within which the wetland site is located (Table 31). Real estate rights acquired for the project will be transferred to the non-Federal sponsors.

Table 37. COMPARISON OF PROJECT AUTHORIZATION OPTIONS APPLICABLE TO THE WETLAND RESTORATION COMPONENT OF THE NER PLAN

Item	Congressionally Authorized Projects (1)	Section 1135	Section 206	Section 204 And 207	Section 510
Non-Federal Share of Implementation Costs	50% feasibility study 35% implementation	25% total project costs	35% total project costs	25% total cost of increment over baseline project	35% total project costs
Federal Share of Implementation Costs	50% feasibility study 65% implementation	75% total project costs	65% total project costs	75% total cost of increment over baseline project	65% total project costs
Sponsor work in-kind	50% of non-Federal share of feasibility study costs. No work in-kind for post-feasibility design, plans & specs, or project construction.	No more than 80% of the non-Federal share of total project costs. Can include plans and specifications, and project construction.	Entire sponsor share may be work in-kind, including plans and specifications, and project construction.	None allowed.	None allowed
Sponsor provided Lands, Easements, Relocations, Rights-of-way, and Disposal costs (LERRD's)	100%; Credit for LERRDs as part of 35% share	100% of those not available from existing project	100%; Credit for LERRDs combined with in kind service cannot exceed 35% of total project cost	Sponsor must pay difference between LERRD's and 25% non-Federal share in cash	100%
Federal Funding Limit	As stated in the project authorization and subject to Section 902 of WRDA 86 cap	$5 million per project; $25 million national program limit annually	$5 million per project; $25 million national program limit annually	None per project; $15 million national program limit annually	None
Operation, Maintenance, Repair, Rehabilitation, and Replacement	100% non-Federal	100% non-Federal	100% non-Federal	100% non-Federal	100% non-Federal
Advantages	Subject project has a high level of Congressional interest—no expected problems with authorization	Already authorized--no delays waiting for authorization	Already authorized--no delays waiting for authorization (can be approved at Division level)	Already authorized—no delays waiting for authorization	Already authorized—no delays waiting for authorization
Disadvantages	Congressional authorization & appropriation can take significant time. Dependent upon WRDA 2002 – status of which unknown	Project subject to limited project funding nationwide.	Project subject to limited project funding nationwide.	Project subject to limited project funding nationwide.	Project subject to limited project funding nationwide.

PROJECT AUTHORIZATION

Congressional approval for construction of a project recommended through the feasibility phase process is called project authorization. In most cases, this process involves hearings on the feasibility report recommendations by the Committee on Public Works and Transportation in the House of Representatives and the Committee on Environment and Public Works in the Senate followed by an individual project authorization by a Water Resources Development Act.

As previously discussed, in some cases, Congress has delegated its authority to approve (authorize) certain projects, up to specified dollar amounts (subject to available funds) to the Chief of Engineers for the Corps of Engineers. One such delegation is the Continuing Authorities Program, which gives the Corps the authority to study, authorize, and construct water resources projects of limited scope and cost. For ecosystem restoration projects under this program, these authorities include Section 1135 of WRDA 1986, as amended (project modifications for improvement of the environment), Section 206 of WRDA 1996 (aquatic ecosystem restoration), and Section 204 of WRDA 1992 (ecosystem restoration in connection with dredging).

Another delegation to the Corps is the authority contained in Section 312(b) of the Water Resources Development Act of 1990, as amended by Section 205 WRDA of 1996 and Section 224 of WRDA 1999. The authority provides for the removal of contaminated sediments for the purpose of environmental enhancement and water quality improvement if such removal was requested by a non-Federal sponsor and the sponsor agreed to pay 35 percent of the cost of removal and 35 percent of the cost of disposal.

A third delegation to the Corps is the authority contained in Section 510 of the Water Resources Development Act of 1996 (Chesapeake Bay environmental restoration and protection program), which allows the Corps to provide environmental assistance to non-Federal interests in the Chesapeake Bay watershed.

Each of the project authorities discussed in the previous paragraphs have potential application to the National Ecosystem Restoration (NER) plan recommended in this report. Section 312(b) is readily applicable to the sediment remediation component of the NER plan and, as such, is the recommended authorization for its implementation. Each of the remaining authorities, including individual Congressional authorization, are more applicable to the wetland restoration component of the NER plan, each with explicit advantages and disadvantages with regard to timeframe, project cost sharing, and other non-Federal sponsor requirements. A comparison of the advantages and disadvantages of these authorities as related to the wetland restoration portion of the National Environmental Restoration plan is presented in Table 37.

The options available for project authorization and advantages and disadvantages of each were discussed in detail with the non-Federal sponsors. As project authority for the sediment remediation component of the NER plan was already in place under Section 312(b) of the Water Resources Development Act of 1990, as amended, the discussion centered on the authority for the wetland restoration portion of the plan.

The draft feasibility document presented that the sponsors cast their support for individual Congressional authorization, in light of high level of Congressional support and concern about potential delays in project funding limitations. In response to the draft feasibility report, the HQUSACE review team commented that ".... If the project were authorized in WRDA 2002, it would compete with other authorized projects for new start funding in FY 2004. There is no less risk in obtaining funding for the project if it is authorized in a WRDA bill. The HQUSACE review team has concluded that there is no advantage to seeking direct congressional authorization for the wetland restoration project. Since there is no guarantee that a WRDA bill will be enacted in 2002 and new start funding could not occur before FY2004, the review team recommends that the district utilize existing authorities (Sections 206 and 312(b)) for this project. Significant timesavings should be realized through utilization of existing authorities".

A Steering Committee meeting attended by all of the non-Federal sponsors was convened on June 1, 2001. The pros and cons of the authorities and the written comments of HQUSACE were thoroughly reviewed and evaluated. The non-Federal sponsors unanimously agreed that the Section 206 authority should be used for the wetland restoration component of the NER plan and that all eight wetland sites be pursued as one Section 206 project. As viewed by the non-Federal sponsors, the distinct advantages to this approach include the potential timesavings, and potential to provide in-kind-services as a portion of their 35% of total project costs.

The District, therefore, recommends that the sediment remediation component of the NER plan be accomplished under the authority of Section 312(b) of the Water Resources Development Act of 1990, as amended, and that the wetland restoration component of the NER plan (which includes all eight wetland sites) be accomplished under the authority of Section 206 of the Water Resources Development Act of 1996, as amended. The sponsors concur.

XIII. CONCLUSIONS AND FINDINGS

SUMMARY

The Elizabeth River is a highly developed, industrialized, urban river system. This development has taken place over a period of more than 200 years. Less than 10% of the watershed remains undeveloped. Losses of habitat and sediment quality degradation have led to significant impacts to the biota of the Elizabeth River that have compromised its value as an estuarine system. For these reasons, the Elizabeth River has been designated as one of three "Regions of Concern" in the Chesapeake Bay by the Chesapeake Bay Program. The Chesapeake Bay Agreement 2000, signed by the governors of Maryland, Pennsylvania, and Virginia, the Mayor of Washington, D.C., the EPA Administrator, and the Chairman of the Chesapeake Bay Commission, identifies the Elizabeth River as a "Priority Urban Water" - "...supporting its restoration as (a) model for urban river restoration in the (Chesapeake) Bay basin".

This document presents, through a plan formulation process, an NER plan that reasonably maximizes environmental restoration benefits compared to costs, consistent with the Federal objective. The recommended plan is shown to be cost effective and justified to achieve the desired level of environmental output.

CORPS OF ENGINEERS GUIDANCE RELATED TO PLAN SELECTION

The USACE, Norfolk District, is pursuing implementation of sediment remedial action and wetlands restoration in the Elizabeth River. Wetland restoration projects are formulated consistent with guidance contained in ER 1165-2-501, Civil Works Ecosystem Restoration Policy, ER 1165-2-502 Ecosystem Restoration - Supporting Policy Information, and Section 206 of WRDA 1996, as amended. Sediment restoration projects have been evaluated consistent with Section 312 of the Water Resources Development Act (WRDA) of 1990, Environmental Dredging, as amended by Section 205 of the Water Resources Development Act of 1996; and Section 224 of WDRA 1999; and as promulgated by Corps of Engineers Implementation Guidance for Section 312 dated 25 April 2001, and ER 1165-2-501. The study is in compliance with ER 1105-2-100 (Planning Guidance Notebook), dated April 2000.

NER PLAN DESCRIPTION

Preceding sections of this document discussed the process of formulating a plan and concluded with a selection of the best plan to resolve the problems and needs of the Elizabeth River. The following paragraphs present a broad description of the recommended plan.

The most appropriate plan for addressing the environmental problems and needs in the Elizabeth River Basin is environmental restoration which involves a combination of both sediment restoration at Scuffletown Creek and wetland restoration at eight different sites throughout the river system.

The sediment restoration component of the NER plan involves environmental dredging, transport of dredged material by barge or truck, permanent placement in a dredged material placement site; and/or temporary placement, treatment, and permanent placement in a regulated landfill.

The wetlands restoration component of the NER plan involves either removal of fill material to attain intertidal salt marsh elevations, grading and planting; and/or depositing clean fill material, building an elevation for intertidal salt marsh, grading, and planting. In higher wave energy environments, protective features such as rock sills will be constructed. Other features of the recommended plan are described below.

Utility Relocations

Preliminary indications are that the recommended plan(s) may impact some existing electric power, telephone service, water, sanitary, or gas utilities in the project area. The exact location of these utilities will be determined prior to construction.

Operation, Maintenance, and Site Monitoring

Annual operation and maintenance (O&M) for the NER plan is approximately $5,150. This includes site monitoring. ER 1105-2-100, Section V (Ecosystem Restoration), Subsection E-30, paragraph (i), Monitoring and Adaptive Management, states that "...Monitoring may be necessary to determine if the predicted outputs are being achieved and to provide feed back for future projects; and ...if cost shared post-implementation monitoring is being considered, it must be clearly defined, justified, and shall be limited to no more than five years following completion of construction. ...The cost of monitoring included in the total project cost and cost shared with the non-Federal sponsor should not normally exceed one percent of the first cost of the ecosystem restoration feature". Project monitoring during the first five years after project construction is cost shared the same as construction (i.e., 65% Federal, 35% non-Federal). After five years, monitoring is a 100 percent non-Federal responsibility.

Restored wetlands are designed to be completely self-sustaining and, once established, should require very little maintenance. Periodic debris removal and spot control of invasive plant species, such as common reed (*Phragmites* sp.), where applicable, may be required on a case-by-case basis. Plant survival during the first 2-3 growing seasons would be required as part of the contract stipulations. Some minimal periodic maintenance will be conducted after year five to perform minor maintenance.

Sediment clean-up in Scuffletown Creek would be designed to reduce levels of contamination which, in turn, would restore benthic community health, finfish and other aquatic life in the river. Once remediated, no maintenance is anticipated. As discussed in the feasibility report, risk of recontamination is expected to be minimal.

Follow-up monitoring at the sediment clean-up site, Scuffletown Creek, would be conducted for up to five years as a cost shared post-implementation work item. The monitoring plan would be performed by or under the guidance of the Norfolk District, COE in cooperation with Virginia DEQ. The plan is intended to measure achievement of the goals and objectives established during planning. Monitoring would include some limited bulk chemical analysis, and measuring benthic community health using a field survey analysis called a Benthic Index of Biotic Integrity (B-IBI). The B-IBI was used to evaluate Scuffletown Creek during the feasibility study and is described in detail previously in this document. After sediment clean-up, the B-IBI would be used in both Scuffletown Creek and an unremediated reference area, Jones Creek, that was also evaluated during the feasibility study.

The NER plan has a (cost-shared) total project construction cost of $13,190,000 with wetland restoration at eight sites and environmental dredging 0-6 feet in Scuffletown Creek. Tables 35 and 36 show the cost sharing distributions. The annual cost of OMRR&R, which includes site monitoring, is estimated at $5,150 ($1,150 for wetland sites, $4,000 for the sediment site). Monitoring costs at the sediment clean up site is estimated at $14,400 (current dollars) each year through the first five years following construction. This amount will be included in the total project construction costs and cost shared with the non-Federal sponsor. Limited maintenance at the wetland sites will occur on a five-year cycle beginning after full realization of benefits, (full realization assumed in year three for both the wetland and sediment sites) and all OMRR&R costs will be 100% locally funded.

Real Estate Acquisition

After consultation and coordination with the non-Federal sponsor, the Federal Government is responsible for determining the lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRD) required for the implementation, operation, and maintenance of the project.

Except in circumstances involving land owned by the United States that is managed by the COE, or where the government can properly exercise its navigation servitude rights, all land determined by the government to be required to support the project must be provided by the non-Federal sponsor. Fee interest is not necessary for the project and a Wetlands Restorations Easement is recommended as shown in the Real Estate Plan.

Generally, the non-Federal sponsor will be afforded credit against its share of project costs for the value of lands, easements, rights-of-way it provides, and the value of relocations it performs, that are required for the project as determined by the government.

Upon completion of the project, the ownership and operation and maintenance responsibilities for all restoration sites will be transferred to the non-Federal sponsors. Real estate rights acquired for the project will be transferred to the non-Federal sponsors.

Plan Accomplishments

Implementation of the recommended plan will provide ecosystem restoration benefits to the Elizabeth River system. The river has been seriously degraded by sediment contamination and loss and degradation of wetlands. The two major initiatives encompassed by the recommended or NER plan include sediment clean-up at Scuffletown Creek and wetland restoration at eight sites located throughout the river system.

Construction, Operations and Maintenance

Construction duration is estimated at 12 months. Average annual operation and maintenance costs for the restoration projects is estimated at $5,150 (includes site monitoring).

Environmental Impacts

The environmental impacts are expected to be relatively minor, of short duration, and, as proposed, will not create any significant or controversial adverse environmental effects. The projects proposed in the recommended plan have been designed to provide a net environmental benefit and to contribute to the sustained environmental restoration of the Elizabeth River. Environmental impacts of the recommended plan are detailed in the Environmental Assessment contained within the main report.

Significant Resources

Some shallow water habitat will be converted to emergent wetland areas. These shallow water areas are "catch basins" for significant stormwater inflow and bottom areas are degraded. Some *Phragmites* (common reed) wetland areas will be converted to low marsh areas vegetated by *Spartina alterniflora*. This is considered a restoration to a former condition prior to man's disturbance.

Threatened and Endangered Species

There are no known rare or endangered animal or plant species located within the project sites that would be adversely affected by the recommended restoration projects.

Cultural and Historical Resources

Extensive literature and some field investigations were carried out for the areas that would be affected by the proposed restoration projects. Many of the sites have been previously disturbed. Many of the former wetland sites now proposed for restoration have been filled with construction debris and other fill material. No adverse impacts to cultural or historical resources are anticipated.

Social Resources

The most significant impact of this plan would be minor disturbances associated with construction activities, particularly those that occur near residential neighborhoods. There will be an improvement in aesthetics and recreational opportunities with implementation of the NER plan.

Resource Protection Measures

State Water Quality Certification pursuant to Section 401 of the Clean Water Act will be applied for and obtained prior to construction. The DEQ provided a letter to the Corps dated 24 May, 2001 stating that "...Based upon our involvement in developing the recommended plan, and the information presented in the draft feasibility document, the proposed activities appear to be permittable under DEQ's authority to grant Virginia Water Protection permits issued pursuant to the State Water Control Law and Section 401 of the Clean Water Act".

Economic Evaluation Measures

The evaluation was conducted based on a 50-year planning period and assumes a base year of 2003. Price levels and development levels are FY 2001. The discount rate utilized is 6-3/8 percent.

Local Cooperation

The non-Federal sponsors of this project are the Commonwealth of Virginia, and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, each public bodies that are legally and financially capable of furnishing the required local cooperation for the recommended plan. The required items of local cooperation will be specified in the draft Project Cooperation Agreement (PCA) that will be developed as a draft during the

Pre-construction Engineering and Design (PED) phase. Prior to project implementation, a final PCA must be coordinated and executed between the non-Federal sponsors and the Federal Government.

XIV. FUTURE STUDY EFFORTS

The Elizabeth River involves many different problems and needs at multiple sites, each representing sizable costs to evaluate. No one feasibility study can address all the problems and needs in the Elizabeth River at once. The cost for such a onetime effort would be staggering and our experience is that potential sponsors are turned-off when faced with the enormity of such a study and the related cost.

As was discussed earlier in this report, the Norfolk District and the non-Federal sponsors are considering three additional follow-on feasibility studies to evaluate contaminated sediment restoration projects at three sites that were identified early in this feasibility study. These sites are Scott's Creek, the former Eppinger and Russell wood treatment facility, and Campostella Bridge. The Norfolk District estimates that based on lessons learned from the first feasibility study, future studies could be completed faster and at lesser cost. With the partnership between the Commonwealth of Virginia and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach in place, the sponsors are very much interested in collectively sponsoring additional feasibility studies. However, at this time all parties are focused on completing this first feasibility study, initiating the first Preconstruction, Engineering, and Design (PED) investigation, and moving closer to construction of the present restoration plan.

Several discussions have been held with the sponsors regarding future feasibility studies, the required funding that would be required with the current effort and any future efforts, and the advance time needed to seek funding through the respective Federal and non-Federal budget processes. Based on these discussions, the district and the sponsors have developed a tentative strategy for future feasibility studies, which involves some staggering in the initiation of those studies. The following table presents a preliminary projection of future studies that generally reflects a short-term, intermediate-term, and long-term strategy for sediment clean-up for the overall Elizabeth River. This strategy has the tentative concurrence of the non-Federal sponsors.

Table 38. PROJECTED PHASING OF FUTURE INVESTIGATIONS TO IMPROVE THE ENVIRONMENTAL QUALITY OF THE ELIZABETH RIVER

Federal Fiscal Year	Current Project	Second Project	Third Project	Fourth Project
1997	Recon Phase completed			
1998--2001	Feas. Phase #1 accomplished			
2002--2003	PED #1 accomplished			
2004--2005	NER Plan #1 constructed	Feas. Phase #2 accomplished		
2006--2007		PED #2 accomplished	Feas. Phase #3 accomplished	
2008--2009		NER Plan #2 constructed	PED #3 completed	Feas. Phase #4 accomplished
2008--2010			NER Plan #3 constructed	PED #4 accomplished
2011-2012				NER Plan #4 constructed

PED = Preconstruction Engineering & Design; NER = National Ecosystem Restoration Plan

XV. COORDINATION

The development of these environmental restoration projects has involved numerous Federal, state, and local agencies. In addition to the COE project delivery team, the following have participated in monthly or other regularly scheduled meetings:

Federal Government:

U. S. Fish & Wildlife Service (USFWS) – Mr. John Gill, Dr. Beth McGee, Mr. Daniel Murphy, Mr. Jason Miller

Commonwealth of Virginia:

Virginia Department of Environmental Quality (DEQ) – Mr. Bert Parolari, Mr. Mark Richards, Ms. Sheri Kattan
Virginia Marine Resources Commission (VMRC) – Mr. Robert Grabb
Chesapeake Bay Local Assistance Department (CBLAD) – Mr. Lee Tyson; Mr. David Kovacs; Mr. Darryl Glover
Department of Game and Inland Fisheries (DGIF) – Mr. Robert Greenlee; Mr. Robert Simmonds
Department of Conservation and Recreation (DCR) – Mr. Ernest Brown
Hampton Roads Planning District Commission – Mr. John Carlock

Universities:

Virginia Institute of Marine Science (VIMS) – Dr. Morris Roberts, Jr., Mr. Walter Priest
Old Dominion University (ODU) – Dr. Daniel Dauer; Mr. Joe Winfield

Cities:

City of Chesapeake – Mr. Lee Dydiw; Ms. Jaleh Pett; Ms. Amy Ring
City of Norfolk – Mr. James Daman; Mr. John Keifer
City of Portsmouth – Mr. James Gildea; Ms. Stacey Porter
City of Virginia Beach – Mr. Clay Bernick

Non-Profit Organization:

Elizabeth River Project (ERP) – Dr. Carl Fisher; Mrs. Marjorie Mayfield Jackson

In addition, this study will continue to coordinate with the following Federal agencies:

Environmental Protection Agency (EPA)
National Marine Fisheries Service (NMFS)
Virginia Department of Transportation (VDOT)
United States Coast Guard (USCG)

XVI. PUBLIC INVOLVEMENT

A strategy for public involvement is displayed in Table 39 and Figures 33, and 34. The Elizabeth River Project has joined with the COE and the non-Federal sponsors to give this project wide visibility and opportunity for input from the public. Several of the wetland restoration initiatives have been presented to local civic groups. Aspects of the proposed sediment restoration project at Scuffletown Creek was presented to the public at the Elizabeth River Project's State of the River Conference on April 28, 2000.

A Sediment Restoration Advisory Committee (SedRAC) comprised of Federal, state, and local government representatives, business and industry, academia, and local citizen groups has been formed and has had two meetings (July 14, 2000 and September 11, 2000). The SedRAC charter is presented in Figure 34. One of the purposes of the SedRAC is to develop a joint plan, coordinate all aspects of the proposed sediment cleanup, and provide opportunity for input and comment as required by Section 312(c) of WRDA. This coordination will continue with additional meetings of the SedRAC throughout the feasibility phase.

As described previously in this report, public support for the proposed restoration projects has been extremely positive. One wetland restoration site was not supported by a local community and, by consensus of the Steering Committee, was deleted from the list of recommended projects. The local sponsors have been informed of the non-Federal responsibilities and intend to furnish these items at the appropriate time. Public involvement will continue with public meetings and information sessions and with the distribution of the draft feasibility report.

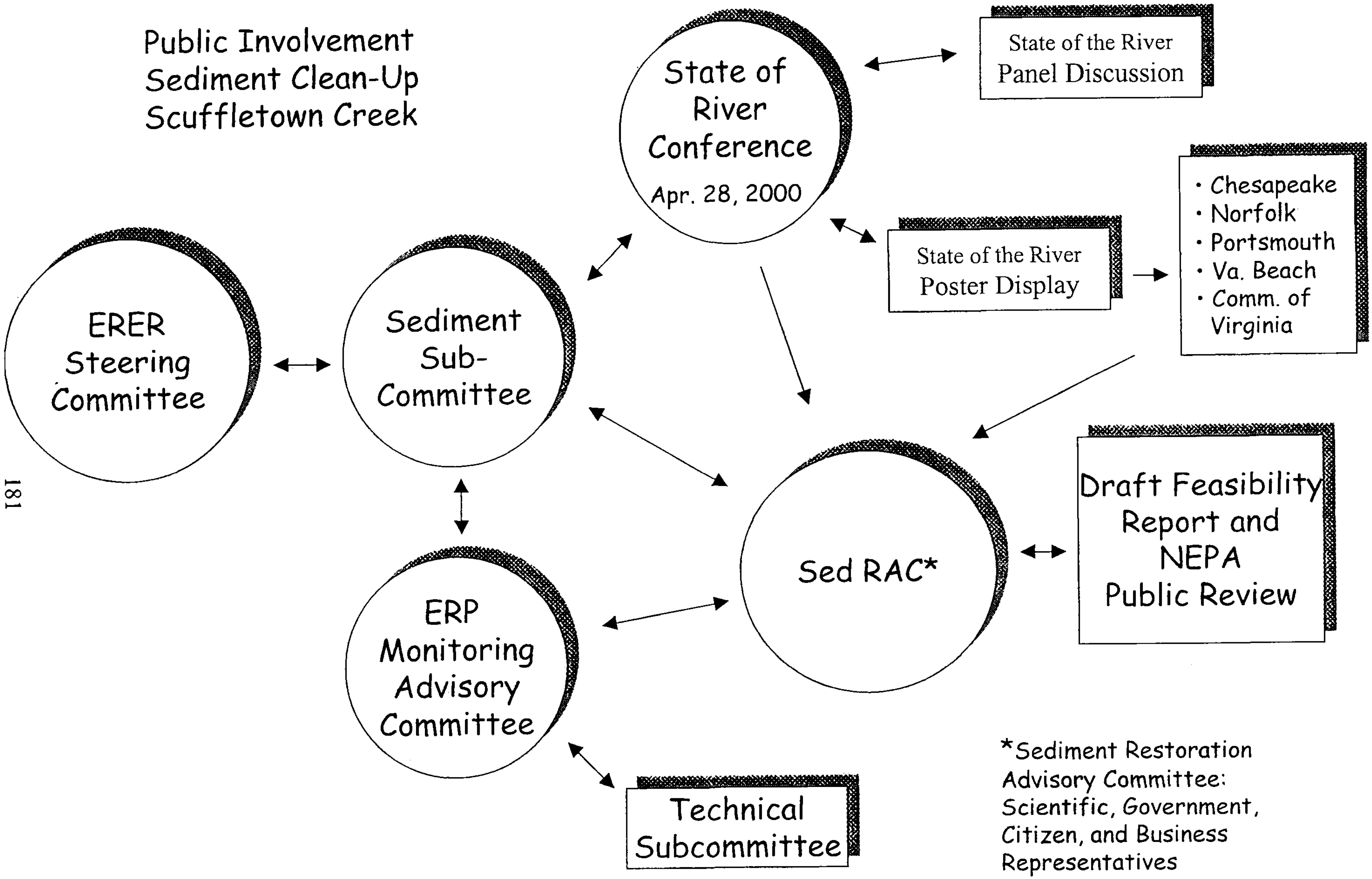


FIGURE 33 . PUBLIC INVOLVEMENT – SEDIMENT CLEAN-UP

June 19, 2000

CHARTER FOR THE SEDIMENT RESTORATION ADVISORY COMMITTEE

PURPOSE: The Sediment Restoration Advisory Committee (SedRAC) is an Advisory Committee of the Elizabeth River Project, and thereby may advise responsible agencies involved in Sediment Restoration, such as the USACE. The purpose of the SedRAC is to encourage community and stakeholder interest and participation in the Elizabeth River sediment restoration effort. Its goals are to:

- Address community and stakeholder concerns,
- Inform the communities and stakeholders about the sediment restoration and seek feedback, and
- Build community and stakeholder support.

STRATEGY: The SedRAC would be modeled after the Restoration Advisory Board's at DOD Restoration Sites and would have a wide-focus on sediment restoration issues. (It would not duplicate the membership of the Steering Committee that advises the Corps of Engineers concerning the Elizabeth River Basin Restoration Project.)

Start with a core group of experts and other persons experienced with the Elizabeth Sediment Restoration efforts (possibly some of the steering committee members) who would lead discussions of issues in SedRAC and educate the committee as a whole. (We could add to the membership of SedRAC as others become interested... especially as issues more closely affect interested parties).

The SedRAC will address a number of issues, including:

- Corps Elizabeth River Basin Restoration Project (evaluate plans and provide recommendations).
- Provide input for developing a master plan for sediment restoration
- Review results of ongoing sediment monitoring with DEQ and provide recommendations for future restoration/remediation
- Address impact of issues related to sediments, such as channel deepening, Craney Island expansion, and other harbor development that may have impacts on sediments or would benefit from improved sediment quality.

MEMBERSHIP.

General. Membership should be diverse and represent, to the greatest extent possible, the interests of all stakeholders affected by the condition of the Elizabeth River's sediments and the communities that border the impacted areas. The ERP should enlist the assistance of city staffs to identify potential members from these communities and stakeholders.

FIGURE 34. SEDIMENT RESTORATION ADVISORY COMMITTEE CHARTER

Potential Membership Pool·

- Prior members of Sediment Quality Task Force, Toxics Reduction Team, and ultimately the entire Watershed Action Team
- Any interested persons of the Elizabeth River Project
- Academia
- Representatives of Federal/State/Local agencies
- City/harbor redevelopment interests
- Work with representatives of cities to identify civic/community organizations that might have members interested in serving on the SedRAC (especially communities neighboring proposed sediment restoration sites
- Stakeholders who would have interest in the condition of the sediments
- Other NGO's interested in State of River

Chair.

- Selection - Appointed by the ERP Board for a two-year term and may be reappointed.
- Qualifications - Working knowledge of sediment restoration issues, time available for coordination of committee, committee facilitation skills, ability to motivate others, persistence and follow-through skills with tasks, ability to work with diverse interests, problem solving skills.
- Duties - Calls meetings on a regular schedule, develops agendas to bring timely issues to the committee, presides at meetings (employing Robert's Rules of Order), oversees preparation of documentation and performs other tasks as assigned by Board

Vice-Chair·

- Selection and Qualifications - Same as Chair
- Duties - Assumes duties and responsibilities in the Chair's absence.

Recording Secretary (May be a volunteer member of the committee and/or ERP staff support)

Professional facilitation may be needed, on occasion.

NOTE: The first meeting of the SedRAC would be held in mid-July, and likely monthly thereafter.

FIGURE 34. SEDIMENT RESTORATION ADVISORY COMMITTEE CHARTER (CONT'D)

Table 39. PUBLIC INVOLVEMENT – WETLAND RESTORATION SITES

Chesapeake	Norfolk	Portsmouth	Virginia Beach
I. City Staff/Public Parks Meetings			
1. Elizabeth River Boat Landing & Park (Scuffletown Creek)		1. Portsmouth City Park	1. Carolanne Farms Park
			2. Woodstock Neighborhood Park
II. Neighborhoods/Civic Leagues Meetings			
1. Elizabeth River Boat Landing & Park (Scuffletown Creek) – So. Norfolk Civic League	1. Grandy Village (Grandy Village) (initiated and ongoing with City and NRHA)	1. Crawford Bay (Swimming Point, Old Towne Civic Leagues)	1. Carolanne Farms Park (Carolanne Farms)
			2. Woodstock Neighborhood Park (Woodstock)
			3. Lancelot Drive (Woods of Avalon)
III. Other Meetings			
1. E. R. Boat Landing & Park: Meet w Radio Tower property owners	1. ODU Drainage Canal (ODU – Facilities Mgmt.)	1. PPIC** Site – NW Side of Jordan Bridge: PPIC; Immobiliare, LLC, So. Norfolk Bridge Comm.	
	2. Grandy Village (NRHA* – ongoing)		

*NRHA = Norfolk Redevelopment and Housing Authority
**PPIC – Portsmouth Port and Industrial Commission

XVII. REFERENCES

Alden, R. W. and J. G. Winfield, Elizabeth River Long-Term Monitoring Management Program – Phase II, A Data and Interpretive Report, AMRL Technical Report No. 917A, 1993.

Alden, R. W. and J. G. Winfield, Defining the Problem: Elizabeth River, A Region of Concern, Old Dominion University, Applied Marine Research Laboratory, Norfolk, Virginia, Prepared for the Virginia Department of Environmental Quality, Chesapeake Bay and Coastal Programs, 1995.

Balicki, Joseph, and Donna Siefert, "Phase II Archaeological Investigations for the Downtown Norfolk Corridor Study, Norfolk, Virginia". Report submitted to the Virginia Department of Transportation by John Milner Associates, Inc., Alexandria Virginia, 1991.

Balicki, Joseph, Charles D. Cheek, Stuart Fiedel, and Dana B. Heck, "Phase I Archeological Investigations at Fort Monroe and Old Point Comfort (44HT27), Hampton, Virginia", Prepared for the Directorate of Engineering and Housing by John Milner Associates, Inc., Alexandria, Virginia, 1999.

Barnard, T. A. and Doumlele, D. G., City of Virginia Beach Tidal Marsh Inventory, Vol. 2, Lynnhaven River, Lake Rudee and Their Tributaries, Special Report No. 217 in Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, Virginia, 1979.

Bender, M. E., W. J. Hargis, Jr., J. Huggett, and M. H. Roberts, Jr., Effects of Polynuclear Aromatic Hydrocarbons on Fishes and Shellfish: An Overview of Research in Virginia, Marine Environmental Research 24: 237-241, 1988.

Bieri, R. H., H. B., C. Hien, R. J. Huggett, P. Shou, H. Slone, C. L. Smith, and C. W. Su, Polycyclic Aromatic Hydrocarbons in Surface Sediments from the Elizabeth River Subestuary, Int. J. of Environ. Anal. Chem. 26: 97-113, 1986.

Birdsong, R. S., R. L. Bedenbaugh and R.D. Owen, Fin Fish seasonality and utilization of Hampton Roads and the entrance channel, Old Dominion University, Applied Marine Research Laboratory, Norfolk, Virginia, 1984

Boesch, D. F., Distribution and structure of benthic communities in a gradient estuary: Ph.D. Dissertation at VIMS, Marvin L. Wass, Chairman, 1971.

Canfield, T. J., F. J. Dwyer, J. F. Fairchild, P. S. Haverland, C. G. Ingersoll, N. I. Kemble, D. R. Mount, R.W. LaPoint, G. A. Burton, and M.C. Swift. 1996. Assessing contamination in Great Lakes sediments using benthic invertebrate communities and the Sediment Quality Triad. J. Great Lakes Res. 22:565-583.

Cerco, C.F. and A. Y. Kuo, *Real –Time Water Quality Model of the Elizabeth River System*, Special Report No. 215 in Applied Marine Science and Ocean Engineering, VIMS, Gloucester Point, Virginia, 104pp, 1981.

Cowardin, Lewis M., V. Carter, F. C. Golet, and E. T. LaRoe, *Classification of Wetlands and Deepwater Habitats of the United States*, U.S. Fish and Wildlife Service, FWS/OBS-79/31, 1979.

Darmody, R.G. and John E. Foss, "Tidal Marsh Soils of Maryland", Maryland Agricultural Experimental Station Publication 930:1-69, 1979.

Dauer, D. M., Virginia Chesapeake Bay Monitoring Program: Benthic Communities Report, 1990-1991. Department of Biological Sciences, College of Sciences, Old Dominion University, Norfolk, Virginia, 90 pp., 1979.

Dauer, D. M., J. A. Ranasinghe, and S. B. Weisberg, Relationships between benthic community condition, water quality, sediment quality, nutrient loads, and land use patterns in Chesapeake Bay. Estuaries 23: 80-96, 2000.

Environmental Management Program for Elizabeth River Basin Appendices, Prepared by the Staff of the Southeastern Virginia Planning District Commission with the Hampton Roads Water Quality Agency, 1989.

Fairey, R., J. Oakden, S. Lamerdin (Moss Landing Marine Laboratories); B. Anderson, J. Hunt, University of California, Santa Cruz; E. Long, NOAA, Assessing Ecological Impacts on Benthic Community Structure from Sediments Contaminated with Multiple Pollutants, NOAA Coastal Ocean Program, 1999.

Gardner, William M., Gwen Hurst and Kimberley A. Snyder, "Phase I Archeological Resource Reconnaissance of Selected Portions of the Marine Barracks Facility, Washington, D.C.", Prepared for Engineering and Environment, Inc., by Thunderbird Archeological Associates, Inc., Woodstock, Virginia, 1999.

Gardner, William M., and John Mullen, "A Phase I Archeological Resources, Reconnaissance of Portions of the 500 Acre Big Bethel Reservoir Facility, Newport News, Hampton and York Counties, Virginia". Prepared for Engineering and Environment, Inc., by Thunderbird Archeological Associates, Inc., Woodstock, Virginia, 1999

Hargis, W. J., M. H. Roberts, and D. E. Zwerner, Effects of contaminated sediments and sediment-exposed effluent water on estuarine fish: acute toxicity, Marine Environmental Research 14: 337-354, 1984.

Higgins, Thomas F., III, "A Phase II Archaeological Evaluation of the Proposed Site for the Relocation of the CO QTR's at the Portsmouth Naval Hospital, Portsmouth, Virginia", Report submitted to HBA by William and Mary Archaeological Project Center, College of William and Mary, Williamsburg, Virginia.

Hyland, J. L., R. F. Van Dolah and T. R. Snoots, Predicting Stress in Benthic Communities of Southeastern U.S. Estuaries in Relation to Chemical Contamination of Sediment, Environ. Toxin and Chemical, Vol. 18, No. 11, pp. 2557-2564, 1999.

Lewis, J. C. and R.L. Garrison, Habitat suitability index models: clapper rail. U.S. Fish and Wildlife Service, FWS/OBS-82/10.51. 15 pp., 1983.

Long, E. R. and D. A. MacDonald, S. L. Smith, and F. C. Calder, *Incidence of Adverse Biological Effects Within Ranges of Chemical Concentration in Marine and Estuarine Sediment,* Environmental Management 19(1): 81-97, 1995.

Long, E. R. and L.G. Morgan, The potential for biological effects of sediment-absorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. Office of Oceanography and Marine Assessment, Seattle, WA, 1991.

McGee, Beth L., D. J. Fisher, L. T. Yonkos, G. P. Ziegler, and S. Turley, Assessment of Sediment Contamination, Acute Toxicity, and Population Viability of the Estuarine Amphipod, *Leptocheirus plumulosus* in Baltimore Harbor, Maryland, USA, Environ. Tox. and Chem, Vol. 18, No. 10, pp. 2151-2160, 1999.

Mothershead, R. F II, R. C. Hale, Influence of Ecdysis on the accumulation of polycyclic aromatic hydrocarbons in field exposed blue crabs (Callinectes sapidus), Gloucester Point, Virginia, Virginia Institute of Marine Science, College of William and Mary 24 pp.

Nichols, M. M. and M. M. Howard-Strobel, Evolution of an urban estuarine harbor: Norfolk, Virginia, Journal of Coastal Research, 7(3): 745-757, 1991.

Priest, Walter I. III, Historic Wetland Loss in the Elizabeth River, The Virginia Wetland Report, Summer, 1999. Vol. 14, No. 2. Virginia Institute of Marine Science, Wetlands Program, 1999.

Priest, W. I., editor. A study of dredging effects in Hampton Roads, Virginia, Spec. Rept. In Appl. Mar. Sci. and Ocean Eng., No 247, Virginia Institute of Marine Science, Gloucester Point, Virginia, 1981.

Ranasinghe, J. A., S. B. Weisberg, D. M. Dauer, L. C. Schaffner, R. J. Diaz, J. B. Frithsen, Chesapeake Bay Benthic Community Restoration Goals, VERSAR, Inc., Report to USEPA, CBLO, and Maryland Governor's Council on Chesapeake Bay Research Fund and Maryland Department of Natural Resources, 49 pp. w/Appendix, 1993.

Roberts, M. H., Jr., A. T. Armstrong, J. Corn, and B., L. Fordan, Quality of water and bottom sediments in the Trinity River. Water Resources Bulletin, 16(3): 522-531, 1980.

Robinson, Gary G., "A Phase I Cultural Resource Survey of the Proposed Route 58 Project, Portsmouth, Virginia", Report submitted to the Virginia Department of Transportation by the William and Mary Archaeological Project Center, College of William and Mary, Williamsburg, Virginia, 1989.

Robinson, R., W. Hansen and K. Orth, Evaluation of Environmental Investments Procedures Manual – Interim: Cost Effectiveness and Incremental Cost Analyses, IWR Report 95-R-1, Corps of Engineers, Water Resources Support Center, Alexandria, Virginia, 1995.

Swartz, R. C., Consensus Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbon Mixtures, Environ. Tox. and Chem., Vol. 18, No. 4, pp. 780-787.

Silberhorn, G. M. and Priest, W. I. III, City of Norfolk Tidal Marsh Inventory, Special Report No. 281 in Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, Virginia, 1987.

Silberhorn, G. M. and S. Dewing, City of Portsmouth Tidal Marsh Inventory, Special Report No. 299 in Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, Virginia, 1989.

Silberhorn, G. M. and S. Dewing, City of Chesapeake Tidal Marsh Inventory, Special Report No. 312 in Applied Marine Science and Ocean Engineering. Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, Virginia, 1991.

The Elizabeth River: An Environmental Perspective, Virginia State Water Control Board, Basic Data Bulletin No. 61, 1983.

Tiner, R. W. and D. B. Foulis, Wetland trends in selected areas of the Norfolk/Hampton region of Virginia (1982 to 1989-90), U.S. Fish and Wildlife Service, Hadley, MA., Ecological Services Report R5-93/16, 18 pp., 1994.

URS Consultants, Inc., Technical Assessments in Support of the Elizabeth River Regional Action Plan Development, Commonwealth of Virginia Department of Environmental Quality (DEQ), Richmond, Virginia .23240, 1996.

Van Veld, P. A., W. K. Vogelbein, R. Smolowitz, B. R. Woodin and J. J. Stegeman, Cytochrome P450IA1 in hepatic lesions of a teleost fish (*Fundulus heteroclitus*) collected from a polycyclic aromatic hydrocarbon contaminated site, Carcinogenesis, 13(3): 505-507, 1992.

Vogelbein, W. K., J. W. Fournie, P. A. VanVeld, and R. J. Huggett, Hepatic neoplasms in the mummichog *Fundulus heteroclitus* from a creosote-contaminated site. Cancer Res. 50: 5978-5986, 1990.

Vogelbein, W. K and D. E. Zwerner, The Elizabeth River monitoring program 1998-99; Mummichog liver histopathology as an indicator of environmental quality, Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, for Virginia Commonwealth of Virginia Department of Environmental Quality (DEQ), Richmond, Virginia, 2000.

Wertenbaker, Thomas J., "Norfolk: Historic Southern Port", Second edition, edited by Marvin W. Schlegel, Duke University Press, Durham, 1962.

Zappi, P. A. and D. F. Hayes, Innovative Technologies for Dredging Contaminated Sediments, Miscellaneous Paper EL-91-20, Department of the Army, Waterways Experiment Station, Corps of Engineers, Vicksburg, Mississippi, 1991.

Maps:

Brown, Calvin, "Plan of the hospital grounds at Portsmouth Virginia", Manuscript in the Virginia State Library, 1853.

Cassell, Charles E., "Plan of the harbor of Norfolk and Portsmouth". Manuscript in the Virginia State Library, 1861.

Cowle, Frederick W., "... the development of a state port at Hampton Roads, Virginia." From Report of the Hampton Roads Port Commission [Commonwealth of Virginia], print in Virginia State Library, 1923.

Dezendorf, J. F., "Map of the Cities of Norfolk and Portsmouth, Adjoining towns and Suburbs", F. W. Beers and Co., New York. Map on file, Geography and Map Division, Library of Congress, Washington DC, photocopy in Virginia State Library, 1876.

["English Army Engineers"], "A Map of Princess Anne County, Virginia,...", Photocopy in Virginia State Library, 1781.

Fyers, William, "Plan of the post of Portsmouth as it is occupied by His Majesty's Forces...", Print in the Virginia State Library, 1781.

Gray, O. W., "Combined map of Norfolk, Portsmouth and Berkeley", Manuscript in Virginia State Library, 1877.

Kelly, James, "Map of the City of Norfolk and the Town of Portsmouth from Original Surveys", Philadelphia, 1851.

Nicholson, George, "Norfolk...a general survey of all the publick streets, lanes and alleys in said Borough...", Manuscript in the Virginia State Library, 1802.

Nimmo, Gershon, "...Surveyed the above town of Portsmouth at he request of Co. William Craford,...", Photocopy in the Virginia State Library, 1752.

Rochambeau, [Comte de], "Plan de Portsmouth en Virginie", Photocopy in the Virginia Department of Historic Resources Archives, Map Cabinet "D", Drawer 4, Folder V-26, original in Map Division, Library of Congress, 1781.

Stratton, [Lieutenant], "A plan of Portsmouth harbour in the province of Virginia: . . .", Print in Virginia State Library, 1781.

Sykes & Gwathmey "Map of Norfolk County, Virginia," Print in Virginia State Library, 1887.

Taylor, Robert B."Map of the Country Contiguous to Norfolk", Photocopy in the Virginia Department of Historic Resources Archives, original in U.S. National Archives, Record Group No. 77, Civil Works Map File, G47-1, 1840.

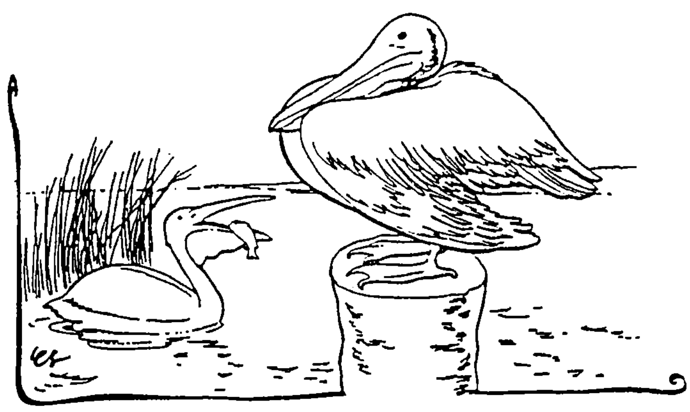
Worcester, George P.,"Map of the City of Norfolk, with Portsmouth and Gosport", Photocopy in the Virginia State Library, 1850.

Young, Edward L., "A plan of the Gosport lands laid off into lotts . . .", Original, May 1816, certified Sept 1877, Photocopy in the Virginia State Library, 1877.

Final Environmental Assessment

ELIZABETH RIVER BASIN, VIRGINIA

ENVIRONMENTAL RESTORATION



U.S. Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, VA 23510

June 2001

FINDING OF NO SIGNIFICANT IMPACT
ELIZABETH RIVER BASIN, VIRGINIA, ENVIRONMENTAL RESTORATION

I have reviewed and evaluated the environmental assessment for this project in terms of the overall public interest. The possible consequences of the alternatives (including the "no action" plan) were considered in terms of probable environmental impact, social well being, and economic factors. The recommended project involves wetland restoration at eight sites throughout the Elizabeth River basin and sediment clean-up at Scuffletown Creek, a tributary to the Southern Branch of the Elizabeth River. Some bottom dwelling organisms and their habitat will be disturbed and/or lost with construction. Existing communities are already disturbed so some minor losses during construction are more than compensated by enhanced opportunities to feed, spawn, and inhabit clean bottom sediments and restored wetlands following restoration. Therefore, there will be an overall improvement in environmental quality in the river.

Shellfish resources will not be impacted adversely by construction of the project. Commercially exploitable benthic resources (clams and oysters) are not present in the project areas of the Elizabeth River. Essential Fish Habitat (EFH) would not be adversely affected by project activities. Precautions will be taken to prevent adverse impacts to finfish resources. There will be both short-term and long-term benefits to EFH from habitat restoration associated with sediment clean-up and wetland restoration including improved abundance and diversity of habitat and food sources, both of which are currently seriously degraded in the river system.

There will be some conversion of one wetland type to another associated with wetland restoration. Wetland restoration involves construction of approximately eighteen (18) acres of intertidal wetlands. Fifteen (15) acres will be constructed by excavating upland fill materials located in prior wetlands. Approximately 1.8 acres of mud flats and shallow water at the receiving ends of major stormwater outfalls will be converted to vegetated intertidal wetlands. There will be a conversion from *Phragmites* sp. (common reed) dominated wetlands to *Spartina alterniflora* dominated wetlands at several sites. Rubble filled wetlands will be restored to their former state.

Due to the dynamic environment of the study area, aquatic organisms are constantly adapting to changes caused by the natural forces of winds, waves, currents, and tides. In addition, there are man-induced disturbances such as boat traffic, which routinely cause resuspension of sediments in the river. Immediate water quality impacts caused by construction for wetland restoration and sediment removal would be temporary and short-lived and are not expected to exceed natural or man-induced disturbances. No significant long-term adverse effects are anticipated. Projects have been developed consistent with the Clean Water Act, Section 404(b)(1) Guidelines.

The conclusions of this assessment are based on an evaluation of the effects that the proposed action would have on the total ecosystem including the land, air, and water resources of the Elizabeth River watershed. Implementing the preferred alternative that includes sediment clean-up at Scuffletown Creek and wetland restoration at eight sites in the river would not have a significant adverse impact on the environment. Conversely, these restoration projects are expected to contribute significantly to environmental quality improvements. Design features and best management practices have been incorporated into the project which would minimize adverse impacts to existing riparian, wetland, open water, and benthic habitat. The effect of the proposed action would not be environmentally controversial.

An Environmental Impact Statement (EIS) will not be required because of lack of significant adverse effects, and long-term beneficial ecosystem restoration effects.

Precautions will be taken, according to best management practices (BMPs), to minimize sedimentation of state waters and to prevent discharge of construction materials or other debris into state waters. All fill material would be clean and would be deposited in such a manner as to prevent its return to state waters.

Since the "no action" alternative would allow a continuation of the current state of degradation of the Elizabeth River ecosystem related to both loss of wetlands and contaminated sediments, this alternative was not selected. The environmental and social benefits of providing restored wetlands and clean bottom sediments are considered greater than the environmental effects resulting from the proposed construction.

18 June 2001

Date

A. B. Carroll

Colonel, Corps of Engineers

District Commander

FINAL ENVIRONMENTAL ASSESSMENT
ELIZABETH RIVER BASIN, VIRGINIA
ENVIRONMENTAL RESTORATION

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FINAL ENVIRONMENTAL ASSESSMENT
ELIZABETH RIVER ENVIRONMENTAL RESTORATION

1.0 PROJECT DESCRIPTION

The Elizabeth River is a highly developed, industrialized, urban river system. This development has taken place over a period of more than 200 years. Less than 10% of the watershed remains undeveloped. Losses of wetland habitat and sediment quality degradation have led to significant impacts to the river's environmental quality and have compromised its value as an estuarine system. The most appropriate plan for addressing the environmental problems and needs in the Elizabeth River Basin is environmental restoration which involves a combination of both sediment restoration or clean-up at Scuffletown Creek and wetland restoration at eight different sites throughout the river system.

Sediment restoration involves environmental dredging, transport of dredged material by barge or truck, permanent placement in a dredged material placement site, and/or temporary placement, treatment, and permanent placement in a regulated landfill.

Wetland restoration in the Elizabeth River system involves either removal of fill material to attain intertidal salt marsh elevations, grading and planting, and/or depositing clean fill material, building an elevation for intertidal salt marsh, grading, and planting. In higher wave energy environments, protective features such as low profile rock/oyster shell sills will be constructed.

A map of the proposed sediment and wetland restoration sites is seen at Plate EA-1. Scuffletown Creek is a tributary to the Southern Branch of the Elizabeth River and is located on the east bank approximately two nautical miles from the Eastern Branch/Southern Branch confluence in the city of Chesapeake and immediately south of

Jordan Bridge (Plate EA-2). Approximately 60,270 yards of contaminated sediments will be dredged from Scuffletown Creek in order to achieve a clean-up level that will sustain and restore aquatic life including bottom dwelling organisms, crabs, shellfish, and finfish.

Eight wetland sites will be restored at various locations along the Elizabeth River. Upon restoration, the restored sites will range from 0.33 to 7.0 acres in size, with overall improved functional quality. Exotic or disturbed site plants of low wildlife value, such as *Phragmites australis*, will be removed and the wetlands will be vegetated with higher quality native vegetation, including *Spartina* sp., *Baccharis halimifolia*, and *Iva frutescens*. The combination of these eight sites, distributed over most of the river basin, will add ecological benefits over a broad geographic area in the Elizabeth River system.

2.0 NEED FOR AND OBJECTIVES OF ACTION

STUDY AUTHORITY

The study was authorized by a resolution dated 14 September 1995 of the House Committee on Transportation and Infrastructure, which reads in part as follows:

> "Resolved by the Committee on Environment and Public Works of the United States Senate, that the Secretary of the Army, acting through the Chief of Engineers be, and is hereby, requested to review studies conducted under Norfolk Harbor and Channels, Virginia, published as House Document 187, 89th Congress and other pertinent reports with specific emphasis on the Elizabeth River, Virginia watershed with a view to determining the need for modifications associated with environmental and related purposes."

The United States Army Corps of Engineers (USACE) Norfolk District, has formulated this plan in accordance with guidance contained in ER 1165-2-501, Civil Works Ecosystem Restoration Policy, and Section 312 of the Water Resources

Development Act (WRDA) of 1990, Environmental Dredging, as amended by Section 205 of the Water Resources Development Act of 1996; and Section 224 of WDRA 1999; and as promulgated by Corps of Engineers Policy Guidance Letter (PGL) No. 49 and ER 1105-2-100 (Planning Guidance Notebook, dated April 2000).

STUDY PURPOSE AND SCOPE

The study area encompasses the entire Elizabeth River Basin located in the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, within the southside Hampton Roads area of southeastern Virginia.

The study evaluates the potential for Federal interest in existing watershed problems that could be addressed by ecosystem and environmental restoration in the Elizabeth River watershed. More specifically, the predominant watershed problems fall into two major categories in the Elizabeth River: loss and degradation of wetlands and bottom sediment contamination.

The industrialization and development of the Elizabeth River system over more than two centuries has had a detrimental effect on the ecological health of the estuary and the aquatic organisms that inhabit the river. The creosote plants, shipyards and dry-docks, oil terminals and coal-loading operations which lined the river's banks have all combined with urban stormwater runoff to contribute to the contamination of the river. Chemical pollutants, both organic and inorganic, from these sources have collected in the sediments and reached harmful levels. Health problems in fish including fin rot, tumors, cataracts, and other abnormalities have all been linked to high levels of pollutants. The pollutants of primary concern are heavy metals and polynuclear aromatic hydrocarbons (PAHs). The sources of heavy metals include shipyards and stormwater runoff. The primary sources of PAHs include petroleum products, coal, the incomplete combustion of fossil fuels, creosote, and stormwater runoff (Alden, 1995).

Sediment contamination concentrations in these areas are much higher than those found elsewhere in the Chesapeake Bay. Concentrations of various contaminants are orders of magnitude above the PELs (Probable Effects Levels) and ERMs (Effects Range Median), sediment quality screening criteria used by the National Oceanic and Atmospheric Administration (NOAA), posing a significant risk to aquatic organisms. Both of these quantitative measurements indicate levels of contamination at which adverse ecological impacts are frequently observed.

Historically, tidal wetlands within the Elizabeth River watershed have suffered significant losses from dredging, filling, and urban development. Less than 10% of the watershed remains undeveloped (Elizabeth River Project, 1992). Approximately 52% of the wetlands were lost from 1944-1977 (Priest, 1999). (See Figure 10 of the Feasibility Investigation for more information.) The Elizabeth River's 350-mile shoreline has experienced extensive loss of wetlands and "vegetated buffers," natural areas which mix trees, shrubs and wetland grasses. Vegetated buffers provide habitat, absorb runoff, trap sediments and filter pollutants. The vegetation also stabilizes the shoreline, takes up potentially harmful nutrients, improves aesthetics, improves air quality and controls flooding.

These losses of habitat and sediment quality degradation from pollution have led to significant impacts to the biota of the Elizabeth River that have compromised its value as an estuarine system (Birdsong et al., 1994).

The purpose of this Environmental Assessment (EA) is to evaluate the environmental impacts associated with various restoration alternatives. This includes a "no action" alternative, and the recommended plan of remediating contaminated sediments in Scuffletown Creek and restoring wetlands at eight sites throughout the Elizabeth River. The evaluations are based on Federal, state, and local statutory requirements and an assessment of Corps of Engineers (COE) environmental, engineering, and economic criteria.

3.0 ENVIRONMENTAL SETTING

The Hampton Roads metropolitan area, located in southeastern Virginia, includes the cities of Hampton, Newport News, Norfolk, Portsmouth, Chesapeake, and Virginia Beach. Hampton Roads Harbor is recognized as one of the finest deepwater natural harbors in the world. It is formed by the confluence of the James, Nansemond, and Elizabeth Rivers. It is located at the southern end of the Chesapeake Bay, approximately 300 miles south of New York, 180 miles southeast of Washington, D.C., and is only 18 miles from the open sea. Because of its accessibility to the Chesapeake Bay and Atlantic Ocean, it is convenient to ports worldwide. Significant natural resources in this region include beach areas along the Atlantic Ocean and Chesapeake Bay; extensive fresh and tidal wetlands, such as the Dismal Swamp; and numerous estuarine areas. The region is rich in fish and wildlife, particularly in areas such as the Chesapeake Bay, Back Bay Wildlife Refuge, and the Dismal Swamp.

The climate of the Hampton Roads area is moderate, tempered by proximity to the Atlantic Ocean and Chesapeake Bay. The winters are usually mild and the autumn and spring seasons are generally pleasant. Summers, though warm, long and humid, are frequently interspersed with cool periods, often associated with northeasterly winds off the Atlantic Ocean. The Chesapeake Bay and Atlantic Ocean are slow in reacting to atmospheric changes, contributing greatly to the humid summers and mild winters. The average annual temperature is approximately 60 degrees Fahrenheit (°F) with ranges in monthly mean temperature from 41 °F average in January to 85 °F in July. The annual precipitation is approximately 42-1/2 inches and is fairly evenly distributed throughout the year. Hot, dry weather in the summer may cause an occasional drought. The area's geographic position with respect to the principal storm tracks is south of the typical path of storms originating in the higher latitudes. It is also north of the usual track of hurricanes and other tropical storms.

Tides in the Elizabeth River are uniformly semidiurnal with a mean range of approximately 2.5 feet at the mouth (Sewells Point) and 3.1 feet at the Southern Branch headwaters near Great Bridge area of the city of Chesapeake. Tidal currents average about 0.9 knot during flood tides and 1.3 knots during ebb tides.

The prevailing wind direction is from the northeast and north in February, March, August, September, and October and south or southwest for the rest of the year, at an average annual velocity of about 11 miles per hour. Wind velocities can exceed 50 miles per hour during hurricanes, passage of cold fronts, and severe thunderstorms. Tides in the Hampton Roads area can be increased to damaging heights by strong northerly winds blowing down the Chesapeake Bay and by strong easterly winds blowing into Hampton Roads from the Atlantic Ocean.

The Elizabeth River Basin area is extremely flat, low lying and featureless, with an average elevation of approximately 11 feet above mean sea level, except for isolated sand dunes along beach areas. The area is traversed by numerous bays and estuaries; streams are shallow and their channels wide and meandering. Except for dredged channels, water depths in the inland bays and connecting waterways are generally less than 10 feet. Because of the elevations, the area is quite often subject to tidal flooding caused by hurricanes and northeasters that frequent the area. Flooding of the low-lying land adjacent to the entrances has caused loss of life, damage to property, and blocking of land traffic arteries. Much of the land in downtown sections of the cities was formerly wetlands or completely under water and has been converted to upland by use of fill material. Scuffletown Creek is a tributary to the Southern Branch of the Elizabeth River on the east side approximately two nautical miles from the Eastern Branch/Southern Branch confluence in the Chesapeake (Plate EA-2).

The Elizabeth River lies in the Atlantic Coastal Plain. A wedge of unconsolidated and semi-consolidated sediment that dips and thickens to the east underlies the Coastal Plain. This sediment lies on a consolidated pre-Cambrian basement rock, which generally consists of deformed igneous and metamorphic rocks. The Coastal Plain sediments are composed of sand, gravel and clay, with some limestone, range from Recent to Cretaceous or older. In the Elizabeth River area, these sediments are approximately 2,800 feet thick and range in age from late Mesozoic to Recent. Although the sediment has not been subjected to deformation, thickness and lithologic composition can be highly variable. Mineral resources of sand, gravel, and peat are available in some of the surface formations in the Coastal Plain.

Soils in the Coastal Plain were developed from unconsolidated marine sediments. The texture of these soils is generally sandy silt from flood plain deposits, clayey silt on fluvial terraces, fine silty sand on higher marine terraces, and clayey silt from Coastal Plain peneplain.

These soils are deep but their drainage characteristics range from well drained to poorly drained. Wetness and poor drainage are prevalent in a number of locations in the region. Low-lying and upland soils are tidal marsh and manmade land fill material.

4.0 ENVIRONMENTAL RESOURCES

AQUATIC RESOURCES

Aquatic resources of major concern located within the Elizabeth River system include commercially and recreationally valuable finfishes as well as a relatively populous benthic community. The Elizabeth River serves as a nursery ground for spot, Atlantic shad, weakfish, and striped bass. In addition, the river serves as feeding grounds for adult weakfish, spot, summer flounder, and Atlantic croaker. No major, successful spawning of striped bass, American shad, or river herrings is known to occur in the Elizabeth River (USFWS, 2001). The most intensive use for spawning is by forage fish, including bay anchovy and Atlantic silverside (Priest, 1981).

Recreational fishing for estuarine and marine species is available in the study area. The Elizabeth River contains fisheries for such species as Atlantic croaker, grey seatrout, striped bass, summer flounder, and bluefish.

According to data obtained from the Virginia Marine Resources Commission for 1994 and 1995, major commercial fisheries on the Elizabeth River, based on estimated harvest, include blue crab, Atlantic croaker, and American eel. Other commercial fisheries, of much less significance in the harvest, include such species as striped bass, bluefish, and grey seatrout. Gear used for this harvest include pots, gill nets, and haul seines.

It is believed that striped bass, American shad, and river herring run up the Elizabeth River in the spring after storm events that provide sufficient freshwater flow in the watershed. No major spawning of anadromous fishes occurs in the river. If any spawning does take place, eggs likely do not hatch due to the presence of brackish water.

Blue crabs are a commercially important estuarine species of the lower James River and the tributaries that empty into the Elizabeth River. They are harvested as both hard-shell and soft-shell crabs for the local seafood market, as well as exported from the Chesapeake Bay area. The lower James River once contained some of the best oyster beds in the world, totaling about 25,000 acres. Oyster abundance in the Chesapeake Bay, however, is at critically low levels.

Numerous benthic surveys have been conducted in the Hampton Roads area (Boesch, 1971; Boesch, 1974; Dauer and Ewing, 1986; Diaz, 1988). The clay/silt substrate that predominates is high in numbers of individual organisms but low in community diversity. Oyster distribution in Hampton Roads Harbor is severely limited by the presence of its major predator, the oyster drill and the disease organisms MSX (*Haplosporidium nelsoni*) and "dermo" (*Perkinsis marinus*), which are typically found in salinities of about 15 parts per thousand (ppt) and greater. Oyster abundance in Chesapeake Bay is at its lowest level in history. Scientists estimate populations are no more than 1% of historic levels (Barber and Mann, 1991; Meyer, 1991). The James River, several miles upriver from the Elizabeth River mouth, is one of the only remaining areas with measurable amounts of oysters. The majority of oysters harvested from Virginia waters during the 1999-2000 season came from this portion of the James River.

Another commercially valuable species is the hard clam, which has a patchy distribution in the Hampton Roads Harbor area near the Elizabeth River mouth. Haven, et al. (1981), researched its abundance and distribution in the harbor. Due to fecal coliform contamination in shellfish areas in Hampton Roads, clams from these areas have been condemned by the Virginia Shellfish Sanitation Commission, but may be used as seed sources by those willing to transfer the mollusks to clean water for harvesting later. Hard clams in the project area have been condemned for direct harvesting by the but may be used after depuration.

Micro and macro-organisms in the planktonic community are numerous and include diatoms, dinoflagellates, foraminifera, skeleton shrimp, jellyfish, stinging nettles, and larval forms of fish, crustaceans and other organisms.

Over the past 25 years, a number of studies of the bottom community have been conducted in the Elizabeth River, primarily the Southern Branch. All of these studies resulted in similar estimates of the bottom community as being highly stressed. Dauer (1994) performed a trend analysis on benthic community parameters (biomass, abundance, species richness and opportunistic versus equilibrium species) for the period 1989-92. Table 1 is drawn from Dauer's (1993) data, provides a comparison of the average values for bottom community attributes in the Southern Branch with a reference site in the York River.

Table 1. COMPARISON OF SIX BENTHIC COMMUNITY ATTRIBUTES FROM THE ELIZABETH RIVER SOUTHERN BRANCH WITH A REFERENCE SITE OF SIMILAR SALINITY IN THE YORK RIVER

Community Attribute	Elizabeth River Southern Branch	York River
Species richness (avg. #/sample)	4-7	10
Biomass (wt./sample)	<1g/m^2	>50g/m^2
Abundance (individuals/sample)	700-2,800	4,000
Biomass deeper than 5cm in sediment	2-15%	60%
Equilibrium species of total biomass	1-15%	80%
Opportunistic species of total biomass	45-75%	5%

The great disparity in biomass and the ratios of opportunistic versus equilibrium species between the Elizabeth River and the York River is striking and all of these measures of community health reflect that the Elizabeth River, and particularly the Southern Branch, has a highly stressed benthic community.

A study of the macrobenthic communities of the Elizabeth River watershed was conducted in summer 1999 (Dauer, 2000). One of the objectives of this study was to characterize the health of regional areas of the tidal waters of the Elizabeth River as indicated by the structure of the benthic communities. These characterizations were based upon application of benthic restoration goals and the Benthic Index of Biotic Integrity (B-IBI) developed for the Chesapeake Bay. In the Elizabeth River, five primary strata were characterized: the Mainstem of the Elizabeth River, the Southern Branch, Western Branch, and Eastern Branch, and the Lafayette River. Two additional strata were sampled for benthic community condition: Scuffletown Creek, the proposed location for sediment contaminant remediation and an additional nearby similar creek system, the Jones-Gilligan Creek complex.

The condition of the seven strata was compared to the results for all Virginia tidal waters for 1999 based upon the random sampling of 100 sites as part of the on-going Virginia Benthic Monitoring Program. In 1999, Virginia tidal waters averaged 30% degraded benthic bottom. All seven strata for the Elizabeth River were higher than this value: 52% for the Mainstem of the river, 64% for the Eastern Branch, 72% for the Western Branch, 92% for the Southern Branch, and 64% for the Lafayette River. Scuffletown Creek and Jones-Gilligan Creek both averaged 76%, failing the Benthic Restoration Goals. In general for all Elizabeth River strata, species diversity and biomass were below reference condition levels while abundance values were within reference condition levels. Community composition was unbalanced with levels of pollution indicative species above, and levels of pollution sensitive species below reference conditions. The only exceptions to these patterns were the mainstem of the river where biomass and levels of pollution sensitive species were within reference condition levels.

Direct evidence of the effects of pollutant stressors on Elizabeth River fishes is provided by Hargis et al., (1984) Owen (1988), Roberts et al., (1988, 1989) Bender et al., (1988) and Vogelbein et al., (1990). These studies reported a high incidence of skin lesions, eroded fins and cloudy corneas in bottom fishes from the Southern Branch. Owen (1988) reported the incidence of external anomalies, primarily lesions, fin erosion and cataracts, to be sixty-nine (69) times higher in Southern Branch fishes than those from the Western Branch.

In toxicity tests conducted by Roberts et al., (1989) spot exposed to Southern Branch bottom sediment and interstitial sediment water displayed high acute mortality, fin erosion and internal and external lesions and cataracts. All spot exposed to 100% Southern Branch sediments taken near the creosote site died within two hours. These effects were attributed to the heavy PAH contamination of the sediment. PAH concentrations in the Southern Branch sediments exceeded 21,000 parts per million (ppm) as opposed to the control sediments from the York River which were 2 ppm.

Vogelbein (2000) conducted a study of fish tissue in resident fish populations in the Elizabeth River as part of the Elizabeth River Monitoring Program (1998-99). In his report he states that "...histopathological endpoints, especially those in the liver, are effective bioindicators of contaminant effects in Elizabeth River mummichogs, and can be used to characterize environmental quality. This is possible because the mummichog is largely non-migratory, with local sub-populations acting as effective integrators of bioavailable chemical contaminants. These fish thereby reflect the quality or health of the immediate environment in the types and severity of toxicant-induced pathologies present".

"Strongest most significant trends were apparent in the proliferative liver lesions which are considered to be indicative of exposure to chemical carcinogens present in localized environments. (Volgebein's) laboratory exposure studies with creosote contaminated sediments and PAH amended sediment and diet provide strong support to the view that this class of lesions arises specifically in the mummichog from environmental exposure to PAHs."

Based on examination of hepatic proliferative lesions in the mummichog, Volgebein used prevalence and severity of these alterations to rank the quality of twelve study sites in the Elizabeth River. The twelve sites ranged in severity from no current problem at four sites in the Elizabeth River to borderline and severe problems at the other eight sites. Criteria for ranking study site quality were based on the occurrence of hepatic proliferative lesions. For further details, see Table 7 in the Feasibility Investigation report.

In addition to taking in toxins directly from the water, because adult crabs are large and long lived, they have the capacity to bioaccumulate toxic chemicals through their diet. Toxic chemicals are typically stored in the hepatopancreas and gonads where they may reach levels considerably higher than in the surrounding water.

The effects may include reduced growth and reproductive capacity, aberrant molting and death although there are no data on the frequency or severity of these effects in the Elizabeth River blue crab population.

While there is no data from which to estimate the health of the Elizabeth River blue crab population, it is apparent from the work of Alden and Winfield (1993) that Elizabeth River blue crabs carry a substantial body burden of pollutants.

WATERFOWL

Waterfowl species that regularly occur on the waterway, in order of relative abundance include mallard, bufflehead, and American widgeon. Other species commonly wintering on these waterways include American black duck, lesser and greater scaup, red-breasted merganser, ring-necked duck, ruddy duck, common goldeneye, green-winged teal, gadwall, northern shoveler, northern pintail, Canada goose, common and hooded mergansers, and wood duck. Species found on these waterways infrequently or in small numbers include tundra swan, mute swan, redhead, surf scoter, oldsquaw, snow goose, and Atlantic brant.

The diving ducks such as canvasbacks, bufflehead, and scaup frequent the open water areas of the Elizabeth River where they feed primarily upon small invertebrates and aquatic insects. Dabbling or puddle ducks such as the mallard and black duck frequent the marshes of these waterways and feed primarily upon seeds and invertebrates.

Waterfowl also frequent the wetlands and open waters of the Elizabeth River in the spring and summer, though they are not nearly as abundant as populations found there in the fall and winter. Species that frequent the study area during these seasons and that typically breed here include Canada geese, wood ducks, black ducks, and mallards.

WETLANDS

Wetlands are defined by the COE as: *Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.* (33 CFR 328.3(b), Regulatory Programs of the Corps of Engineers; Final Rule.)

Near its headwaters and in the more rural and undeveloped portions of the watershed, the Elizabeth River has fairly extensive saltmarsh communities dominated by saltmarsh cordgrass *(Spartina alterniflora)*. The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory Maps generally classify these portions of the Elizabeth River as E2EMIP (estuarine, intertidal, emergent, persistent, and irregularly flooded).

Although the study area is generally characterized as supporting dense urban and suburban development, wetland systems occasionally occur along the river and in scattered undeveloped areas. Those wetland systems located within the study area are characterized by a mosaic of wetland types, including palustrine forested, palustrine emergent, estuarine, lacustrine, and riverine. Wetland systems in the study area are usually bordered by or residential, commercial, or industrial development.

The Virginia Institute of Marine Science (VIMS) has completed tidal marsh inventory reports for all four cities in the Elizabeth River watershed: Chesapeake (Silberhorn, et. al., 1991), Norfolk (Silberhorn and Priest, 1987), Portsmouth (Silberhorn and Dewing, 1989), and Virginia Beach (Barnard, et al., 1979). These reports document the type and distribution of tidal marshes in the basin.

THREATENED AND ENDANGERED SPECIES

A search of the Virginia Department of Game and Inland Fisheries species database in November 1999 indicated that eight threatened and endangered species might exist within the project area of the Elizabeth River Basin (Table 2).

Table 2. THREATENED OR ENDANGERED SPECIES IN THE ELIZABETH RIVER BASIN

Status	Common Name	Scientific Name
FE[1]	Falcon, peregrine	*Falco peregrinus*
FE	Woodpecker, red-cockaded	*Picoides borealis borealis*
FT[2]	Eagle, bald	*Haliaeetus leucocephalus leucocephalus*
FTST[2,6]	Piping Plover	*Charadrius melodus*
FSSE[3]	Bat, eastern big-eared	*Corynorhinus (= Plecotus) rafinesquii macrotis*
FSST[4]	Shrike, migrant loggerhead	*Lanius ludovicianus migrans*
SE[5]	Rattlesnake, canebrake	*Crotalus horridus atricaudatus*
ST[6]	Sandpiper, upland	*Bartramia longicauda*
ST	Shrike, loggerhead	*Lanius ludovicianus ludovicianus*
FE[1]	Seaturtle, Kemps Ridley	*Lepidochelys kempi*
FT[2]	Seaturtle, Loggerhead	*Caretta caretta*

1 Federally Endangered
2 Federally Threatened
3 Federal Species of Concern, State Endangered
4 Federal Species of Concern, State Threatened
5 State Endangered
6 State Threatened
Source: Taken from the Virginia Department of Game and Inland Fisheries species database http://151.199.74.222/scripts/oicgi.exe/inet_xlate

HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE (HTRW) INVESTIGATIONS

HTRW investigations were conducted in accordance with ER 1165-2-132 "Water Resources Policies and Authorities, Hazardous, Toxic and Radiological Waste (HTRW) Guidance for Civil Works Projects" and NAD DR 1165-2-1, "Procedures for Conducting and Coordinating HTRW Investigations for Civil Works Projects." Specifically, the evaluations conducted during this feasibility phase of study in the Elizabeth River included the following activities:

1. Define the project corridor where construction and/or excavation would take place for proposed wetland restoration and sediment clean-up projects.
2. Research historical maps, photos, documents, and conduct interviews to

2. Research historical maps, photos, documents, and conduct interviews to determine where and what type industries had been located in the project areas in the past. Review existing and past property uses according to the likelihood of discovering HTRW.

3. Look at current aerial photos, location maps, and conduct visual site surveys to identify industries, landfills, storage tanks, and other potential HTRW sites.

4. Consult with state regulatory agencies for license/permit actions, for any violation, enforcement, and/or litigation against property owners, and for general information about local HTRW problems such as illegal dumping, leaking underground storage tanks, soil or groundwater contamination, etc.

5. Conduct field investigations for HTRW as warranted by background investigations described previously.

5.0 BOTTOM SEDIMENT CONTAMINATION EVALUATIONS

EXTENT AND VOLUME OF CONTAMINATION

A Sediment Subcommittee was formed to address the issue of sediment contamination in the Elizabeth River. Representatives included individuals from the Virginia Department of Environmental Quality (VDEQ), U.S. Fish and Wildlife Service (USFWS), Virginia Institute of Marine Science (VIMS), Old Dominion University (ODU), Elizabeth River Project (ERP), and COE personnel. Since no criteria for sediment contamination, treatment and removal levels exists, the Subcommittee was faced with developing a criteria of its own that would apply to the proposed sediment restoration at Scuffletown Creek.

The approach to evaluating the sediments in Scuffletown Creek was developed by the Sediment Subcommittee and included looking at both chemical and biological indicators of sediment degradation. The approach is similar to the widely accepted "triad" approach, except that in addition to looking at sediment quality, toxicity, and benthic community health (the triad), this investigation also looked at the incidence of fish tumors/cancer in a resident fish population (mummichog).

In 1999, sediment core samples were collected at 148 stations in Scuffletown Creek from the mouth upstream to the Route 464 Bridge Project limit. The purpose of the bulk chemical analyses of 0 to 1 foot and 1 to 2 foot core sediment samples was to evaluate the distribution of various contaminants with respect to area and depth. Samples were analyzed for physical attributes, particle size, and bulk chemical (inorganic and organic) by EA Engineering, Science, and Technology, Inc. Additional data were collected in FY 2000 to fill in data gaps and more clearly define the vertical extent of contamination within defined "hot spot" areas in the creek. All of the sites sampled during the first phase are depicted on Plate EA-3.

Particle size analysis of the Scuffletown Creek sediment samples indicated that the sediments are composed primarily of silts, clays, and fine sands. Inorganic and organic analyses of the sediment samples indicated that most core sediments are contaminated according to established sediment quality criteria.

There are several approaches that have been used to evaluate sediment quality. These approaches have been developed to quantify the potential toxic effects of contaminants in sediments. These include NOAA's Effects Range - Low (ERL), Effects Range - Median (ERM), Threshold Effects Level (TEL), and Probable Effects Level (PEL) limits, and Environmental Protection Agency's (EPA) Sediment Quality Guidelines. The ERL/ERM and TEL/PEL values were derived by comparing levels of sediment contaminants with observed effects in sediment-dwelling organisms so they can be used to estimate concentrations at which adverse biological effects could be observed (rarely, occasionally, or frequently). As an example, if an observed contaminant did not exceed the ERL or TEL, then biological effects would rarely be observed. To the contrary, if an observed contaminant exceeded the ERM or PEL, then biological effect would frequently be observed.

An extensive chemical survey was conducted in Scuffletown Creek to determine the magnitude and extent of sediment contamination. One hundred forty-eight stations were sampled in the creek. Sediment contaminant concentrations in these samples were compared to the sediment quality benchmarks. This information was plotted on a map of the creek to visualize the distribution of contaminants. These maps were useful in identifying contaminant "hot spots"; however, because the sediments were contaminated with a mixture of chemicals, including metals and PAHs, the approach did not allow the derivation of clean-up values.

The Subcommittee wanted to find a way to integrate this information and present it on a single scale which would reflect both the magnitude and frequency at which sediment quality benchmarks were exceeded. Several researchers (Hyland et al., McGee et al., Long et al., Canfield et al.) have used Sediment Quotient Values (SQV) to synthesize this type of information. The SQV is calculated by dividing the concentration of a contaminant in a sample by its sediment quality benchmark (i.e., ERM), summing these quotients for all chemicals of concern, then averaging the score. Therefore, each site gets a single number that reflects not only how many contaminants exceed the benchmark but also by how much.

McGee, et al., 1999, Fairey, et al., 1999, and Canfield et al., 1996, found direct relationships between this type of SQV and levels of toxicity and/or benthic community impairment. Fairey concluded that, "Chemical summary quotients provide a useful tool for assessing sediment contamination at locations where interrelated effects of multiple chemicals are possible or expected". B. McGee (unpublished) data indicated that ERM SQVs of 0.4 and 0.8 delineated ranges where, at the low end, there was no observed effect and, at the high end and above, there was always an observed effect in toxicity tests using Baltimore Harbor sediments. Therefore, the Subcommittee decided that 0.4, 0.6, and 0.8 would be the SQV values that would be contoured to develop "hot spots" in

Scuffletown Creek for analysis and possible remediation. The SQV method generated "hot spots" that were very similar to those generated by looking at the ERM and PEL values separately, which adds more confidence to the validity of the assessment of "hot spot" locations.

The Norfolk District conducted a three-dimensional analysis (Groundwater Modeling System, or GMS) to determine the extent and volume of contaminated sediments using the results of the sediment sampling events. See Figures 18, 19, and 20 in the Feasibility Investigation report for further information.

Biological indicators of the ecological condition of Scuffletown Creek were also evaluated, including toxicity tests (surface and subsurface sediments); Benthic Index of Biotic Integrity (B-IBI) – a measure of benthic community health; and fish (mummichog) histopathology. The results of these tests are presented in Table 3. These biological indices, in combination with elevated levels of sediment contaminants as compared to recognized sediment quality criteria, provide a weight of evidence which confirms the degraded condition of Scuffletown Creek.

Table 3. EVALUATION OF SEDIMENTS IN SCUFFLETOWN CREEK

Measure	Results
B-IBI (Benthic Index of Biotic Integrity)	• 76% Degraded bottom • No deep dwelling organisms • 4% pollution sensitive species • 67% Pollution-indicative species
Toxicity – Surface Sediments (1-2 cm)	Low Toxicity (>80% survival)
Toxicity – Subsurface Sediments	High Toxicity (0-40% survival)
(Fish) Histopathology	• Borderline Problem • AHF* 5-20% • Neoplasms 0%
Sediment Quality	• Organics up to 9X the ERM** • Metals up to 6X the ERM

*AHF: Altered Hepatocellular foci are small precancerous liver lesions
**NOAA Effects Range Median (ERM) = Based on NOAA guidelines - used to delineate the potential biological impact of a variety of contaminants. Chemical concentrations at or above the ERM represent a probable effects range within which effects would frequently occur.

SEDIMENT EVALUATION AT OTHER SITES

As mentioned previously, three other sediment sites were evaluated during this study. These were Scott's Creek, the former Eppinger and Russell wood treatment facility on the Southern Branch, and in the Campostella Bridge area of the Eastern Branch (See Plate EA-1). Both bulk chemical analysis and sediment toxicity was evaluated. The complete presentation of data is found in Appendix E, Environmental Technical Reports, to the Feasibility Report. Based upon the preliminary investigations at these 3 sites, the highest levels of contamination were found at Eppinger and Russell, then Scott's Creek, and finally at the Campostella Bridge site. This information should be evaluated carefully for determining future, follow-on feasibility investigations.

6.0 WETLANDS EVALUATIONS

The Reconnaissance Study recommended nineteen candidate wetland sites at various locations along the main, Eastern, Southern, and Western Branches of the Elizabeth River, to be evaluated for restoration feasibility. As a result of feasibility investigations, however, eight of the nineteen sites were eliminated from further consideration. Reasons for discontinuing sites from further analysis included the following: sites held exclusively by private property owners, entailing sometimes problematic private property issues that local sponsors were reluctant to tackle; site constraints such as buildings, public roadways, and utilities, that did not allow adequate space for the development of a viable wetland restoration project; former landfill sites that would have required excavation and may have exposed unknown contaminated materials; former industrial uses at a site in which the soils had been contaminated with petroleum hydrocarbons and semi-volatile organic compounds, the restoration of which via constructed wetlands may have created a more efficient conduit for these chemicals to enter the river; a mature wooded site possessing desirable habitat values and riparian buffer characteristics that would have been lost through conversion of the site to wetlands; and a site with complex, unresolved stormwater management issues. Elimination of these sites from further consideration left eleven candidate wetland restoration sites.

These eleven sites are located along various reaches of the main, Eastern, Southern, and Western Branches of the Elizabeth River in four jurisdictions: the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach. As they exist currently, the sites vary in size of existing wetlands from 0 acres (currently no functioning wetlands on-site) to 2.9 acres. Restoration at all sites would entail site preparation, earthwork, and landscaping. At all sites, both the areal extent of the wetland system, as well as the quality of the wetland structure, would be increased or improved. Restored sites would vary from 0.33 acres to 7.0 acres in area. Design features of each of these wetland restoration plans are described in detail in Engineering Appendix A and Attachment B to this appendix.

Various size scales at each of the restoration sites were given careful consideration. However, in most cases, the sites are so geographically constrained by existing urban development and infrastructure that breaking down the site into smaller components would not be feasible from an ecological standpoint. In other words, the wetland sites require certain minimum areas to function effectively, to self-regulate, and to maintain structure. Since nine of the eleven proposed restoration sites vary in size from just 0.33 to 1.6 acres, wetlands ecologists on the study team determined that breaking these sites down into smaller scales would threaten their integrity and probability of success. The other driving factor that determined site size was that each site was configured so as to be contiguous with other adjacent, undisturbed, wetland areas. Reducing site size often meant losing its connection with an existing wetland, thereby reducing the overall ecosystem benefit.

7.0 ALTERNATIVE PLANS

"NO-ACTION"

The first alternative considered is the "no action" alternative. Dredging contaminated sediments within Scuffletown Creek would not be done, and none of the proposed wetland sites would be restored. The expected future conditions if the proposed project is not completed is a continuation of the present conditions, i.e., continued scarcity of wetland habitat leading to continued habitat degradation, reduced water quality, and suppression and decline of aquatic resources in the Elizabeth River. Without dredging and remediation of contaminated sediments in Scuffletown Creek, communities of bottom dwelling organisms will continue to be degraded and other flora and fauna in the area will continue to exhibit physiological stress from exposure to contaminated sediments. Because the "no action" alternative would result in continued degradation in the Elizabeth River and loss of fish and wildlife resources, this alternative was eliminated from further consideration.

SEDIMENT CLEAN-UP ALTERNATIVES

During the Reconnaissance investigation, several areas in the Elizabeth River were identified as "hot spots" or areas where sediment contamination was likely to be causing degraded biological conditions. These areas were identified by a Steering Committee and were selected based on a review of the literature and documented sources of adjacent upland historical contamination.

For sediment restoration, the reconnaissance report (905(b) analysis) pared a comprehensive list down to five separate geographical areas, with only one of these areas, Scuffletown Creek, to be evaluated intensively during the first feasibility study for a proposed clean-up effort under Section 312(b) of WRDA 1990, as amended, environmental dredging. This creek is a tributary to the Southern Branch of the Elizabeth River and is located on the east bank approximately two nautical miles from the Eastern Branch/Southern Branch confluence in the city of Chesapeake. Located on the opposite shore, less than 1/2 mile across the river, are two former creosote plants, Atlantic Wood Industries and Wycoff Pipe and Creosote which operated from the 1920's until the mid-1900's. Atlantic Wood is a Superfund site currently under remedial action. The Wycoff property is owned by Portsmouth Port and Industrial Authority. A city park is located at the mouth of the creek.

As part of the plan formulation process, an array of scenarios was considered to address the clean-up of contaminated sediments and restoration of disrupted habitats in the creek. All scenarios were evaluated assuming the clean-up took place solely under the 312(b) authority. The Elizabeth River Steering Committee through its Sediment Sub-Committee developed the technical aspects of sediment evaluation and evaluated potential restoration solutions. The COE also convened a "Scuffletown Dredging Team" comprised of district scientists and engineers evaluating the engineering and environmental aspects of the potential clean-up solutions. Clean-up scenarios considered during initial screening of alternatives ranged from "no action," to containing sediment in place (capping), to *in-situ* treatment, to dredging scenarios that included shallow dredging, and deeper dredging, or a combination of dredging and capping (Table 4).

Table 4. INITIAL SCREENING OF SEDIMENT REMEDIATION ALTERNATIVES

Contaminated Sediment Remediation Alternatives	Results	Action
1. "No action"	Continuation of degraded conditions: sediments toxic to aquatic organisms; fish abnormalities, depressed bottom dwelling community health, elevated contaminate levels, widespread migration of contaminated sediments	Drop
2. Contain Sediment in Place (Capping)	May not be practical in shallow water; may preclude possibility of future deepening for navigation; may be cost effective	Retain for further evaluation and cost analysis
3. Treat Sediment in Place	Not practical: difficult to insure all contaminants treated; not demonstrated effective on large scale	Drop
4. Environmental Dredging - Remove (dredge) and contain dredged material	Demonstrated to be effective on large scale; tried and proven technology	Retain for further design and cost analysis
5. Environmental Dredging - Remove (dredge) and treat dredged material	Demonstrated to be effective on large scale; tried and proven technology	Retain for further design and cost analysis

Alternatives that were assessed after the initial screening pertained to dredging technologies, dredging scenarios, transfer/dewatering options, treatment technologies, transportation to a disposal site and eventual disposal of dredged sediment at a dredged material placement site and/or a regulated solid waste landfill site. These alternative plan components were subsequently considered in various potential combinations, and progressively evaluated by USACE, Norfolk District's, "Scuffletown Dredging Team" and the Sediment Subcommittee. Alternatives were assessed for engineering and economic feasibility, and environmental and social acceptability. The details of the process are discussed in some detail in the following narrative.

Capping of Contaminated Sediments

An estimate was prepared for the cost of installing a two-foot clean sand cap over the contaminated areas for each of the three ERM SQV levels of clean up that were evaluated. While the cost for capping is less than dredging and removal, capping at Scuffletown Creek is not a practical alternative because: 1) capping would preclude any possibility of dredging the site in the future, as dredging would then expose or release underlying contaminated bottom sediments; and 2) capping would convert much of the shallow water and mud flats in the creek into upland areas.

Additional difficulties with capping include the potential disruption of the hydrology of Scuffletown Creek in such a way as to create non-contiguous basins with the potential for reduced tidal flushing and anoxic conditions.

For these reasons, capping within Scuffletown Creek was eliminated from further consideration as a feasible restoration alternative.

Environmental Dredging

Dredging the contaminated sediments out of Scuffletown Creek was the preferred alternative. This site has little chance, due to its location, of recontamination. The chosen level of sediment clean-up is to the 0.6 ERM SQV value. Plate EA-4 shows the areal extent of the sediments that will have to be dredged in order to achieve this level of clean-up. This represents a median level of clean-up, with 0.4 ERM SQV being the highest level of clean-up and 0.8 ERM SQV being the lowest level of clean-up. The 0.6 ERM SQV level was selected as providing the greatest environmental benefit with the minimum effort and cost. Once an ERM SQV of 0.6 is achieved, the benthic community should be able to approach the parameters for a similar site in the York River, a relatively unstressed benthic community (Table 1). Furthermore, the benthic community should be able to bioremediate the site to an even lower ERM SQV number once the 0.6 level is achieved, due to increases in species diversity and numbers of benthic organisms. The benthos will also be able to burrow much deeper into the sediments and survive, which will also speed up the bioremediation process by exposing deeper sediments to higher oxygen levels and more aerobic decomposition (Table 5).

Benefit Measure	Base Condition	0.8 SQV Minimum Level of Clean-Up	0.6 SQV Medium Level of Clean-Up	0.4 SQV Maximum Level of Clean-Up
Sediment Quality	Many Contaminants Present at High Levels POOR	Some Contaminants Present – Lower levels FAIR	Fewer Contaminants Present– Lower levels GOOD to FAIR	Fewest Contaminants Present– Lower levels GOOD
Fish Cancer and Precancer	REDUCED CANCERS AND PRECANCERS			
Bottom Community Health	POOR Primarily <u>one</u> pollution-tolerant species	FAIR - Less Abundance & Diversity - Few Deep Dwelling Forms	GOOD TO FAIR - Greater Abundance & Diversity - More Deep Dwelling Forms	GOOD - Closest to Reference Conditions (Ches. Bay)
Toxicity of Subsurface Sediments to Bottom Dwelling Organisms	POOR High Toxicity	FAIR Moderate Toxicity	GOOD TO FAIR Moderate to Low Toxicity	GOOD Low Toxicity

Table 20. BENEFITS RELATED TO THREE LEVELS OF SEDIMENT CLEAN-UP

DREDGING TECHNOLOGIES COMPONENT

Environmental dredging pertains primarily to removal of contaminated sediments by dredging with equipment that will minimize turbidity and the re-suspension of contaminated sediments. Criteria for selecting the dredging equipment to accomplish this removal action were identified. Numerous dredge types, including mechanical, hydraulic, and special purpose dredges were listed, characterized, and evaluated using the selection criteria. Several options appear acceptable, including mechanical dredges, the closed bucket clamshell, cutterhead, and horizontal auger dredge. Other operational controls may be considered, as appropriate.

The first identified environmental dredging alternative involves the use of a closed bucket clamshell, a mechanical dredge to remove some contaminated sediments. This dredge is capable of high production rates, is able to remove both sediments and debris, and can navigate some portions of Scuffletown Creek. The use of a closed bucket clamshell, readily available within the Hampton Roads area, as well as consideration of operational controls, could help to reduce adverse environmental effects caused by this dredging.

The second identified environmental dredging alternative involves the use of a cutterhead dredge, a hydraulic dredge, to excavate Scuffletown Creek sediments. This dredge is the most commonly used dredging plant and is versatile, capable of dredging clays, silts, sands, gravels, etc. The cutterhead dredge is also able to dredge while generating reduced amounts of turbidity. As with the closed bucket, other operational controls may be considered to reduce environmental effects.

The third identified dredging alternative involves the use of both mechanical and special purpose hydraulic dredging equipment. A closed bucket clamshell dredge could be used first to remove the majority of the contaminated sediments. In order to excavate the last of the sediment intended for removal, without performing significant over-dredging, a special purpose dredge with greater vertical control than the closed bucket could complete the dredging operation. Two special purpose hydraulic dredges that have greater vertical control and generate relatively low amounts of turbidity include the horizontal auger dredge and the matchbox suction head dredge. Additionally, the cable arm bucket may provide greater vertical control.

Additionally, primary mechanisms of contaminant loss associated with remedial action activities were identified. Subsequently, an array of potential environmental protection measures were identified and evaluated for applicability to the project conditions and applicability to minimize primary mechanisms of contaminant losses. Applicable water quality controls, dredging operation controls, and/or environmental controls could be placed on the dredging operation to limit adverse impacts of this sediment removal action. Water quality controls may include placing limits on the amount of turbidity or concentrations of contaminants allowed in the water column outside the immediate dredging area. Dredge operation controls might include limiting the bucket cycle time, prohibiting nighttime dredging operations, and not allowing buckets and scows to be overfilled. In addition, watertight scows and/or trucks should be required for transporting contaminated sediments. While it is virtually impossible to completely eliminate all environmental impacts of this dredging action, controls such as these can greatly reduce impacts.

Various types of mechanical dredges were considered feasible given the logistical constraints of Scuffletown Creek. Various types of bucket dredges and excavators, including a closed clamshell bucket, are being considered as the most appropriate equipment for dredging in the creek.

The clean-up will involve dredging sediments from depths up to 6 feet to remove contaminated sediments from identified "hot spots". This will involve removal of approximately 60,270 cubic yards of sediment. Various dredges designed and operated to have minimal environmental impacts will remove the contaminated sediments. Depending on level of contamination, the contaminated sediments will then be transported by watertight scows and trucks to treatment and/or disposal sites.

WETLAND RESTORATION ALTERNATIVES

The "no action" alternative has already been considered and rejected. Nineteen sites were initially considered for restoration. Most were wetlands at some time in the historical past. One alternative would be to restore all nineteen proposed sites. Restoring all nineteen sites was rejected due to a variety of issues that made restoration of a number of sites not feasible at this time (Table 6).

Table 6. ELIZABETH RIVER ENVIRONMENTAL RESTORATION WETLAND SITES FEASIBILITY STATUS

Site Locations Investigated	City	Feasibility Status
1. Great Bridge Locks Park	Chesapeake	Site investigation discontinued – valuable riparian habitat would have to be graded to create wetland
2. Scuffletown Creek	Chesapeake	Surveys, Cost Est. and Preliminary Design completed
3. Western Branch Park	Chesapeake	*Phragmites* (common reed) control
4. (Former) Municipal Landfill Site, North of Municipal Center, Great Bridge	Chesapeake	Site investigation discontinued – former landfill; excavation and related regulatory concerns
4. East of Campostella Bridge/Site 1	Norfolk	Site investigation discontinued – private property issues
5. East of Campostella Bridge/Site 2	Norfolk	Site investigation discontinued – private property issues
6. East of Chesterfield Heights (Grandy Village)	Norfolk	Surveys, Cost Est. and Preliminary Design completed
7. Lamberts Point/Drainage Channel	Norfolk	Site investigation discontinued – former landfill; excavation and related regulatory concerns
8. Harbor Park Shoreline	Norfolk	Site investigation discontinued – site constraints
9. Tidewater Dr. @ Lafayette River	Norfolk	Surveys, Cost Est. and Preliminary Design completed
10. West of Old Dominion University (ODU Drainage Canal)	Norfolk	Surveys, Cost Est. and Preliminary Design completed
11. Mouth of Steamboat Creek	Norfolk	Site investigation discontinued – already a functioning wetland; debris removal only

Table 6. (con't) ELIZABETH RIVER ENVIRONMENTAL RESTORATION WETLAND SITES FEASIBILITY STATUS

12. Portsmouth City Park	Portsmouth	Surveys, Cost Est. and Preliminary Design completed
13. Northwest side Jordan Bridge (old Wycoff Pipe)	Portsmouth	Surveys, Cost Est. and Preliminary Design completed
14. Paradise Creek (throughout)	Portsmouth	Site investigation discontinued – private property issues; *Phragmites* (common reed) control
15. Scotts Creek (3 sites)	Portsmouth	1. Surveys, Cost Est. and Preliminary Design completed for one site (Sugar Hill) 2. London Blvd. – discontinued - narrow site constraints/ high elevation make wetland restoration infeasible 3. W. Park View – discontinued due to private property issues
16. Crawford Bay	Portsmouth	Surveys, Cost Est. and Preliminary Design completed
17. Swimming Point	Portsmouth	Site investigation discontinued – subsurface soils investigations uncovered petroleum product contamination related to prior industrial use of site

Shaded = Preliminary design, cost estimate, completed

Several of the proposed restoration sites are held exclusively by private property owners. It was determined that the non-Federal sponsors of this project were reluctant to pursue wetland restoration on privately held land, so several sites were dropped from further consideration.

Site constraints caused the elimination of several sites from further consideration. Buildings, public roadways, utilities, borders with private property, and other factors did not allow adequate land or space to develop a wetland on the proposed site.

Two of the sites were at former landfills. Because restoring these sites would involve excavation within a landfill, unknown fill materials could compromise the restored wetlands. They may bear further study in the future, but were eliminated from the present study at the direction of the non-Federal sponsors.

One site, Swimming Point in Portsmouth, was eliminated from further study due to petroleum hydrocarbons and semi-volatile organic compounds being detected during a COE subsurface soils investigation in November 1999. A recovery well is also present on the site and has removed over 400 gallons of product from the subsurface since its installation in April 1995. If this site is restored at this time, these products are more likely to enter the river. It is recommended that further removal of product occur before restoration of this site be considered further.

Great Bridge Locks Park in Chesapeake had a site proposed for restoration to a wetland. However, this site is presently a functional riparian buffer with large trees and understory vegetation. Due to its being a functioning habitat of value, further wetland restoration development was not recommended.

The Kings Creek Site in Virginia Beach was eliminated from further consideration at this time due to this site receiving a significant volume of stormwater from adjacent roadways. If this site was restored at this time, it is likely to continue to receive a large amount of stormwater runoff, with associated sediments. It is likely this site would once again become chemically contaminated and/or colonized by the common reed *Phragmites australis*.

Of the remaining eleven sites two were eliminated from further consideration due to their small size and small potential benefit, if restored. These sites may be restored with future restoration efforts once other, larger sites are rehabilitated.

The preferred alternative is to restore eight sites. Restoring these sites will provide a significant ecological benefit to the Elizabeth River watershed. A significant number of wetland acres will be restored (Table 7). These sites will either be excavated or filled with clean wetland sediments as needed and restored to historical wetland grade, where possible. The sites will then be vegetated with native wetland plants. Species to be planted include *Spartina alterniflora*, *S. patens*, *Baccharis halimifolia*, and *Iva frutescens*. Details of the planting scheme are presented in Engineering Appendix A.

Table 7. RECOMMENDED PLAN - WETLANDS RESTORATION

Site	City	Original Acres	Acres Restored
1. Scuffletown Creek	Chesapeake	0.08	0.33
2. East of Chesterfield Heights (Grandy Village)	Norfolk	2.90	7.00
3. West of Old Dominion University (ODU Drainage Canal)	Norfolk	0.03	0.60
4. Portsmouth City Park	Portsmouth	0.16	0.85
5. Northwest side Jordan Bridge	Portsmouth	0.095	1.20
6. Woodstock Neighborhood Park	Virginia Beach	0.11	1.60
7. I-64 Crossing of E. Branch (Lancelot Drive/Avalon Hills)	Virginia Beach	1.30	5.40
8. Carolanne Farm Park	Virginia Beach	0.022	1.22
TOTAL		4.7	18.2

Other alternatives to restore fewer than eight sites were considered. Several different "buy in" levels were considered, based primarily on an economic analysis. For example, the lowest level "buy in" that would provide some environmental benefits at minimal cost would be to restore the NW Jordan Bridge, Grandy Village, and Carolanne Farms sites. However, the maximum ecological benefit, in terms of functioning wetlands, links to remaining wetlands, and potential wildlife habitat, can be obtained by restoring eight of the eleven remaining potential sites. Table 8 depicts the proposed solution at each of the candidate sites:

Table 8. WETLAND SITES AND PROPOSED RESTORATION SOLUTIONS

Location	Current Condition	Proposed Solution
Scuffletown Creek, Chesapeake	Filled (former) Wetland	Excavate, grade, plant
Grandy Village, Norfolk	Filled (former) Wetland	Excavate, grade, plant
ODU Drainage Canal, Norfolk	• Intertidal • Shallow Water • Stormwater	Fill, grade, plant
NW Jordan Bridge, Portsmouth	• Intertidal • Shallow Water • Stormwater	Fill, grade, plant
Portsmouth City Park, Portsmouth	Filled (former) Wetland	Excavate, grade, plant
Lancelot Drive, Virginia Beach	Filled (former) Wetland	Excavate, grade, plant
Carolanne Farms, Virginia Beach	Upland	Excavate, grade, plant
Woodstock Park, Virginia Beach	Borrow Pit	Fill, grade, plant

8.0 ENVIRONMENTAL BENEFITS

WETLANDS

The benefits of each of the alternative restoration sites were characterized in terms of two assessment methodologies: a Habitat Evaluation Procedure (HEP) and a wetlands functional assessment score. The HEP methodology, in widespread use since first developed by the USFWS in the early 1980's, compares the suitability of habitat conditions in the study area for a particular species, to ideal conditions for that same species. HEP takes into account both the quality and quantity of habitat by multiplying a species-specific numerical habitat suitability index (HSI) by the areal extent of the habitat under consideration. The HSI value, which varies from 0 to 1 ("0" represents no value as habitat, while "1" represents ideal habitat), is multiplied by acreage to yield habitat units. Habitat units serve as a quantitative expression of environmental output.

For the Elizabeth River wetlands, several avian, mammalian, and fish species HSI models were initially considered in evaluating the quantity and quality of wetlands habitat. However, because in most cases the models' requirements did not fit the river and shoreline conditions in the urban and industrial sites proposed for restoration, only one avian species, the clapper rail (*Rallus longirostris*), was selected. The clapper rail was considered an appropriate "indicator species" (i.e., a species indicative of overall wetlands ecosystem health) both because the emergent marsh and shoreline habitat are critical habitat for a number of important bird species, and because the clapper rail has multiple life requisite factors (food, cover, reproduction, water) within the proposed restoration habitats identified.

The candidate restoration sites were inventoried by the study team and measured in terms of habitat variables (i.e., percentage of total area covered by persistent salt or brackish emergent or scrub/shrub wetlands) critical to supporting the life requisites of the clapper rail. Using the USFWS *Habitat Suitability Index Models: Clapper Rail*, an HSI value was calculated for each restoration site, which was then multiplied by site acreage to yield the number of habitat units. At each site, the expected number of habitat units to occur in the future in the absence of the restoration project was subtracted from the number of habitat units expected to occur with the restoration project. That difference in habitat units (between "with" and "without-project" conditions) represents the "benefits" due to the site restoration. See HEP Tables in Appendix C of the Feasibility Report for a detailed breakdown of future "without-project" and "with-project" HSI values and habitat units by wetlands restoration site. The habitat units were converted to average annual equivalent units to reflect the fact that full ecosystem benefits would not occur until year three of the project life.

The second methodology employed to assess the environmental benefits of each of the alternative restoration sites is a wetlands functional assessment score. The concept behind the functional assessment is to capture the range of beneficial functions provided by wetlands systems, such as the capacity of wetlands to produce plant material to support aquatic food chains, to provide fish and wildlife habitat, to improve water quality, to reduce shoreline erosion and help reduce shoreline flooding, and to improve community aesthetics and provide educational opportunities. A panel of subject matter experts, composed of biologists from COE, USFWS, VIMS, developed a functional numerical index in which the values recorded for each of seven wetlands functions were assigned a score of between 1 (low) to 5 (high) to describe how well each wetlands site performs a specific function. The wetlands functions considered include: 1) primary production, measured by organic production, decomposition, and availability of plant material food to aquatic organisms; 2) fish and wildlife habitat, as measured by tidal regime, ratio of cover to open water, ratio of shoreline to wetland area, and cover type diversity; 3) water quality, characterized by watershed area, detention time, width of wetland, percent cover, and stormwater features; 4) erosion buffer, as measured by vegetative cover type, width of marsh, slope of marsh, and elevation of marsh; 5) flood buffer, measured by storm tide volume and floodplain width; 6) aesthetics, characterized by "greenspace" availability, existing degradation, and site visibility; and 7) public accessibility and educational value, characterized by accessibility of site, proximity to schools and neighborhoods, and recreational opportunities. See Functions Benefits Tables in Appendix C in the Feasibility Report for a complete description of wetlands functional definitions, measures, and index scores.

The expert panel judged the existing condition, the expected future without-project condition, and the expected future "with project" conditions for the eleven alternative restoration sites, on the 1 to 5 scale for each of the seven measurements of wetlands functions. The seven separate functional index scores were weighted equally and then summed to provide a more complete representation of how well each wetland site contributed across wetland functions. The highest possible score (a score of 5 for all seven functions) was therefore calculated to be a score of 35.

Functional scores at each site were then multiplied by acreage at that site to reflect the fact that the functional benefits provided would be proportional to the size of the wetlands. This proportionality technique is analogous to the habitat unit concept, in which both quality and quantity are important factors in the determination of environmental outputs. Projected scores at each site ranged from 0 to 60.9 for the "without-project" future condition; and from 8.58 to 231.0 for the with-project future condition. Expected functional scores under each alternative restoration site were compared to the expected future "without-project" score (and the difference calculated) to yield an overall numerical value of wetlands improvement or benefit.

The numerical functional scores were converted to an average annual equivalent to reflect the fact that full ecosystem benefits would not occur until year three of the project life.

SEDIMENT CLEAN-UP

Three alternative restoration plans, each associated with different levels, or degrees, of contaminated sediment clean-up, were considered for sediment restoration in Scuffletown Creek. Each sediment restoration plan consisted of dredging of contaminated sediments, transport, by barge or truck, of the dredged material to a dredged material management area, treatment, if necessary, of the dredged material by biocell or PUG (stabilization) technologies, and placement of the dredged material either on site at the dredged material management area or at a solid waste landfill.

The three restoration alternatives were differentiated in terms of the amount of material to be removed from the bottom of the Scuffletown Creek channel. In turn, the amounts of material to be removed have a direct bearing on the clean-up levels that can be achieved. As discussed previously, clean-up levels were defined in terms of mean ERM sediment quotient values (SQV). Of the alternatives considered, a mean ERM SQV of 0.8 reflected the highest residual contaminant level remaining in the Scuffletown

Creek substrate and least amount of sediment clean-up (minimum clean-up). A mean ERM SQV of 0.6 represented a medium level of residual contaminant and corresponding clean-up (medium clean-up), while a mean ERM SQV of 0.4 equated to the lowest level of residual contamination and highest level of clean-up considered (maximum clean-up).

The benefits of each of the alternative restoration plans were characterized in terms of a functional score based on five separate measurements of the health of the Scuffletown Creek ecosystem. The five measurement techniques consisted of a benthic index of biotic integrity (B-IBI); the toxicity of the surface layer (1-2 cm deep) of bottom sediment to benthic (bottom dwelling) organisms; the toxicity of the sub-surface layer to same; histopathology and the presence of neoplasms (cancer) in fish species; and sediment quality as expressed as the presence of contaminant constituents in the sediment exceeding sediment quality criteria (TEL/ERL or PEL/ERM). The following table explains how these measurements indicate the relative health of the ecosystem.

Table 9. SEDIMENT RESTORATION INDICES AND EXPLANATIONS

Index of Sediment Restoration	Explanation
B-IBI	B-IBI is a multi-metric index that scores benthic community metrics (abundance, biomass, species diversity, etc.) compared to reference locations. Sediment clean-up can begin recovery of benthos (bottom dwelling organisms). Benefits related to improvement in B-IBI scores (indicative of improved benthic community health).
Toxicity of Surface Layer	Surface (surficial) layer defined as top 1- 2 cm of river bottom sediment. Some benthic organisms live on or in only this top layer. Fishes, etc., feed on these organisms. Surface layer typically less well consolidated (i.e., "fluff"), and often subject to change (both chemically and physically). Benefits related to toxicity reductions and more abundant, non-toxic, fish food in this layer.
Toxicity of Subsurface Layer	Subsurface layer defined as sediment below top 2 cm of surface. Subsurface layer often related to historical deposition of sediment. Deeper burrowing organisms, a variety of clams, worms and other invertebrates, inhabit these sediments. Benefits related to toxicity reductions and more abundant, diverse (deeper dwelling), non-toxic, fish food.
Histopathology - Fish tumors, cancers, and deformities	Contaminated sediment may contribute to fish tumors, cancers, deformities, and death. Clean-up that reduces contaminants will restore those populations and make fish less susceptible to these diseases. Benefits are related to healthier, more abundant and diverse fish populations.
Contaminated Bottom Sediment (Sediment Quality)	If contaminated sediment has contributed to degradation of fish and wildlife habitat, then reductions in gross levels of contaminants will lead to restoration of fish & wildlife populations. Benefits are related to reduction in contaminant levels and correlated restoration of fish and wildlife habitat and species populations.

A panel of subject matter experts (Sediment Subcommittee members) developed a functional numerical index in which the values recorded for each measurement technique were assigned a score of between 1 (poor) to 7 (excellent) to describe conditions of ecosystem health. For example, in characterizing the toxicity surface layer measurement technique, a functional index score of 1 (poor) would reflect high toxicity (less than 50% survival rate); a score of 3 (fair), moderate toxicity (50-80% survival rate); a score of 5 (good), low toxicity (over 80% survival rate); and a score of 7 (excellent), no toxicity (100% survival rate). See tables in Appendix C for a complete presentation of sediment restoration measurement techniques and corresponding functional index scores.

The expert panel judged the existing condition, the expected future "without-project" condition, and the expected future conditions under the three alternative restoration plans, on the 1 to 7 scale for each of the five measurements of ecosystem health. The five separate functional index scores were weighted equally and then summed to provide a more complete representation of ecosystem health. The highest possible score (a functional score of 7 for all five measurement techniques) was therefore calculated to be a score of 35. Projected scores ranged from 14 for the without project future condition to 19 for the 0.8 mean ERM SQV alternative; 22 for the 0.6 mean ERM SQV alternative; and 24.5 for the 0.4 mean ERM SQV alternative.

Expected functional scores under each alternative restoration plan were compared to the expected future "without-project" score (and the difference calculated) to yield an overall numerical value of ecosystem improvement or benefit.

The numerical functional scores were converted to an average annual equivalent to reflect the fact that full ecosystem benefits would not occur until year three of the project life. The functional score benefits of each of the alternative restoration plans are displayed in Table 10.

Table 10. SEDIMENT CLEAN-UP COSTS AND BENEFITS

Increment	Total First Cost	Functional Score
0.8 Mean ERM SQV	$4,728,426	4.90
0.6 Mean ERM SQV	$7,170,887	7.84
0.4 Mean ERM SQV	$15,135,657	10.29

9.0 ENVIRONMENTAL IMPACTS

ENVIRONMENTAL DREDGING AND CONTAMINATED SEDIMENT REMOVAL

Dredging to remove sediments can be expected to have short-term impacts upon local flora and fauna, and possibly impact organisms living downstream from the proposed dredging site. One definite impact of the proposed dredging of Scuffletown Creek will be the removal and loss of benthic organisms living in and on the sediments. Few, if any, shellfish, including oysters and clams live in the sediments in this creek. Depressed populations of polychaetes (marine worms) and benthic crustaceans (such as crabs) living in the area may be adversely effected. There are no oyster grounds in Scuffletown Creek and no commercial harvest of clams or oysters currently occurs in the Southern Branch. Field investigations conducted by ODU (D. Dauer 2000) indicate that bottom dwelling community is primarily comprised of a single pollution tolerant species and that occupies only the top 1-2 cm of sediment.

There will be some resuspension of sediments during dredging operations and it is possible that aquatic life downstream of the Scuffletown dredging operations will be affected during the construction period. Potential effects could be related to both the physical and chemical properties of the sediments. Suspended sediments can cause smothering of benthic life by covering them or clogging their gills. Suspended sediments will cause a temporary increase in turbidity and a slight decrease in dissolved oxygen levels. Also, downstream benthic organisms could be exposed to contaminants in the suspended sediments. No Submerged Aquatic Vegetation (SAV) beds are currently known to exist in the Elizabeth River or in Scuffletown Creek and vicinity. Impacted benthic organisms should be able to recover quickly, as organisms in estuarine environments are well adapted to frequent sediment movement and resuspension associated with tidal currents, storms, and vessel traffic.

Sediments in Scuffletown Creek are composed primarily of silts, clays, and fine sands and have elevated levels of contamination. Some rubble and debris may be removed as well. Various types of mechanical dredges are considered feasible for this project for their minimal environmental impacts. These dredges are various types of bucket dredges, including a closed clamshell bucket. It may also be possible to use a hydraulic cutterhead dredge to excavate the contaminated sediments in deeper water near the creek mouth. All applicable water quality controls, dredging operation controls, and other environmental controls will be placed on the dredging operation to limit adverse impacts of the proposed sediment removal. Water quality controls could include placing limits on the amount of turbidity or concentration of PAHs/metals or other contaminants allowed in the water column outside the immediate dredging area. Dredging operation controls could include limiting the bucket cycle time, prohibiting nighttime dredging operations, and not allowing transport scows, which are recommended to be watertight, to be overfilled.

While there may be some short term adverse impacts to local populations of benthic organisms, fish and other resident aquatic life, sediment clean-up is expected to result in the long term recovery of a more diverse assemblage of bottom dwelling organisms, including recovery of both shallow and deeper dwelling organisms such as clams and other invertebrates. The recovery of these populations will, in turn, provide more abundant, non-toxic food for aquatic organisms at higher trophic levels in the river.

Prior to construction, a Virginia Water Protection Permit will be obtained from the Commonwealth of Virginia, Department of Environmental Quality (DEQ), in conformance with Section 401 of the Clean Water Act (CWA). DEQ letter dated 24 May 2001 states that "...Based upon our involvement in developing the recommended plan, and the information presented in the draft feasibility study document, the proposed activities appear to be permittable under DEQ's authority to grant Virginia Water Protection permits issued pursuant to the State Water Control Law and Section 401 of the Clean Water Act."

DREDGED MATERIAL TRANSPORT

As mentioned previously, the sediment restoration plan consists of dredging of contaminated sediments, transport, by barge or truck, of the dredged material to a dredged material management area, treatment, if necessary, of the dredged material, and placement of the dredged material either on site at the dredged material management area or at a solid waste landfill.

Dredged material will be transported by either watertight scows and/or trucks to the designated staging or final placement site. All precautions will be taken to prevent spillage of dredged material during loading, transport, and offloading.

DREDGED MATERIAL CONTAINMENT

There are several proposed sites for placement of dredged material. The Craney Island Dredged Material Management Area (CIDMMA), a 2,500 acre COE owned confined disposal facility in Hampton Roads Harbor, cannot be used for permanent placement of the Scuffletown sediments because they are being removed solely as a restoration effort. By law, only dredged material removed for navigation related purposes can be placed permanently at CIDMMA. However, it is possible that some or all of the Scuffletown sediments could be stored temporarily at CIDMMA prior to treatment or final deposition at another site. Another potential site for final placement of the Scuffletown sediments is the Higgerson Buchanan Site, located on the Southern Branch of the Elizabeth River and formerly used for dredged material placement in the early 1980's in connection with Southern Branch channel deepening to 35 feet (Plate EA-5).

In addition, it is probable that a percentage of the Scuffletown Creek dredged sediments will need to be treated to remediate the contaminants. Proposed treatments include both physical and biological remediation of contaminants. Treatment would be performed in a staging area after the sediments are removed.

Dewatering and dredged material disposal facility effluent discharges will need to meet DEQ water quality standards for the body of water receiving the effluent. Appropriate permits and/or certifications would be required. Dewatering may be accomplished primarily via settling. Adsorption of pollutants to sediments and the settling of sediments and associated pollutants out from the water column is generally recognized as the primary pollutant removal/containment process within a dewatering facility. Pollutants associated with dredged materials are strongly attached or adsorbed to the organic and clay factions. As the particulates settle out, the pollutants adsorbed to the particulates are also removed from the water column and contained in the sediments. In most cases, after settling the water will meet discharge standards. This may take one to several days.

It is also possible that some or all of the Scuffletown dewatered/treated dredged sediments could be placed in a solid waste landfill as long as they meet the landfill disposal criteria. There are several in the area that could be used: Big Bethel, SPSA Regional, and Mount Trashmore landfills (Plate EA-5).

WETLAND RESTORATION

Wetland restoration involves either: 1) removal of fill material to attain intertidal salt marsh elevations, grading and planting; and/or 2) depositing clean fill material, building an elevation for intertidal salt marsh, grading, and planting. In higher wave energy environments, protective features such as rock/oyster shell sills/breakwaters will be constructed.

Restoring the eight sites to fully functioning wetlands with associated native vegetation will involve use of construction equipment and vehicles to grade, remove upland fill and/or fill with clean soil, depending on the site. It is critical that all sites be graded to achieve the elevations needed to support the desired intertidal wetland. In most cases, emergent wetlands will be created, with associated upland buffer areas.

Grading of Upland Areas

Several of the wetland restoration sites will require excavation of fill material and some grading to achieve required elevations to sustain saltmarsh intertidal wetlands. Historical maps and records indicate that these areas were wetlands at one time but were filled to create fastland. There will be a permanent loss of upland habitat and associated vegetation. In the case of several sites, such as portions of Grandy Village and Lancelot Drive, there will be a conversion of *Phragmites* sp. (common reed) dominated areas to *Spartina* sp. (saltmarsh cordgrass) dominated areas.

Fill for Wetland Restoration

At the ODU Drainage Canal site, the NW Jordan Bridge site, and the Woodstock Neighborhood Park (borrow pit) site, varying quantities of coarse grained fill material will be placed in the shallow water/intertidal zone to develop a substrate (bench) for planting the emergent wetland. A low profile breakwater/sill (oyster shell and rock) will be constructed at the seaward edge of the restored wetlands at the ODU Drainage Canal and Jordan Bridge sites to protect the restored area from wave attack. Placement of material will result in some direct loss of bottom dwelling organisms by burial, except for more motile species such as crabs which could escape these effects. Since the wetland base fill will consist of mostly coarse grained material, of similar grain size and composition to indigenous river shoreline sands, turbidity impacts are expected to be short-lived and spatially limited to the vicinity of the fill placement. Tables 11 (all sites) and 12 (shallow water fill sites) indicate how much bottom area would be impacted by the proposed wetland construction.

Table 11. WETLANDS AND AQUATIC HABITAT EFFECTS

Vegetation or Aquatic Habitat Type	Wetland Restoration Site															
	Scuffletown Creek		NW Jordan Bridge		Carolanne Farm Park		Woodstock Neighborhood Park		Lancelot Drive		Grandy Village		ODU Drainange Canal		Portsmouth City Park	
	Existing	Future With Project	Existing	Future With Project	Existing	Future With Project	Existing	Future With Project	Existing	Future With Project	Existing	Future With Project	Existing	Future With Project	Existing	Future With Project
Tidal Creeks (acres)	0	.04	0	0	0	.34	0	0	0	0.3	0	0	.002	.052	0	.33
Mud Flats (acres)	.021	0	.705	0	0	0	0	0	0	0	0	0	.70	0	0	0
Shallow Water (acres)	0	.01	.40	0	0	.10	0.5	0	0	0	0	0	.10	0	0	0
Common Reed (acres)	.009	0	0	0	0	0	.50	0	5.40	0	2.0	0	0	0	0	0
Salt Bush (acres)	.051	.05	0	.10	.50	.10	.40	2.0	0.1	1.7	.20	.80	0	0	0	.12
Emergent Salt Marsh (acres)	0	.18	.095	1.1	.17	.52	.2	1.34	1.20	4.60	2.7	4.7	.03	.63	0	.40
Sill – Breakwater/ Shell Reef (acres)	0	0	0	.33	0	0	0	0	0	0	0	0	0	.15	0	0
Riparian Buffer (acres)	0	.05	0	0	0	.16	0	.06	0	0	0	2.5	0	0	0	0

Table 12. WETLAND SITES MUDFLAT AND SHALLOW WATER IMPACTS

Location	Current Condition	Shallow Water Impact/Loss (acres)	Mudflat Impact/Loss (acres)	Saltmarsh Wetland Gain (acres)
NW Jordan Bridge, Portsmouth	• Intertidal • Shallow Water • Significant stormwater input	.40	.70	1.1
Woodstock Neighborhood Park, Virginia Beach	• (Former) Borrow Pit • Significant stormwater input	.50	0	2.94
ODU Drainage Canal, Norfolk	• Intertidal • Shallow Water • Significant stormwater input	.10	.70	.68
TOTAL		1.0	1.4	4.72

Once restored, the wetland intertidal areas will repopulate relatively quickly. The quantity and diversity of benthic organisms will differ somewhat from the intertidal mudflats and shallow water populations existing now. However, there will also be many similar species.

The proposed restoration site at ODU is located at the receiving end of a major stormwater outfall draining a large portion of the ODU campus and parking areas. The Jordan Bridge site is located at the receiving end of a major stormwater outfall draining properties located adjacent to two former creosote plants and a major shipyard north of the Jordan Bridge. Stormwater input and these industries are thought to have significantly contributed to the degraded status of the bottom sediment habitat in these areas. The man-made borrow pit at Woodstock is also a receiving basin for stormwater and sediments from adjoining neighborhoods. The immediate effect of these wetland restoration projects will be a loss of mud flats and/or shallow water and the associated organisms in these areas. However, the long-term effect will be an improvement in sediment (i.e., habitat) quality, wetland filtering capacity to provide water quality improvements, and the health, abundance, and diversity of the aquatic organisms able to populate and survive in these improved conditions.

Table 13. ENVIRONMENTAL EFFECTS OF SEDIMENT CLEAN-UP AND WETLANDS RESTORATION

Indices	Wetland Restoration	Environmental Dredging
Air Pollution	Minor effects. CAA Conformity determination concluded air emissions safely below final rule's *deminimus* levels.	Minor effects. CAA Conformity determination concluded air emissions safely below final rule's *deminimus* levels.
Noise Pollution	Some short-term negative impacts to local wildlife on sites with some wetlands present. Possible short-term impacts to people living near certain sites. No long-term negative effects.	Possible short-term impacts to citizens using public city park near mouth of Scuffletown Creek. Effect should be very minimal. No long-term negative effects.
Water Quality	Possible erosion of sediments during construction phase will be mitigated using BMPs and placement of temporary timber matting and stone as needed.	BMPs will be employed to minimize impacts. Dredging may take place during the day with a monitor and transport scows will be watertight. Any increases in turbidity due to suspended sediments will be short-lived.
Destruction of Manmade and/or Natural Resources	No manmade structures will be effected, certain facilities (hiking trails, boat launches, benches) will be improved or have improved access/aesthetics due to project. Natural resources will be enhanced by the project.	No manmade resources will be negative effected. Local benthos will be removed by the dredging, but the area should repopulate quickly. Long-term effects should increase species diversity and abundance.
Wetlands	Loss of approx. 1.4 acre mudflats and 1 acre shallow water adjacent to stormwater input. Gain of approx. 13 acres emergent salt marsh and 5 acres of high marsh (saltbush).	Removal of contaminated sediments from shallow water areas. Long term improvement in bottom community health.
Essential Fish Habitat (EFH)	No EFH would be adversely effected by the project.	Short-term decrease in food supply due to removal of local benthos by dredging. Suspended sediments will be minor and localized in a relatively secluded portion of the river. EFH will be enhanced from reduced sediment contamination which will result in increased abundance & diversity of benthic invertebrate food items for fish, and reduced incident of fish cancers, tumors, and abnormalities.

ENVIRONMENTAL IMPACTS SUMMARY (USFWS REPORT DATED NOVEMBER 30,2000)

"Most of the biological effects of this project are positive. Impacts to water quality and upland, wetland, and shallow water fish and wildlife habitats are minimal compared to the benefits derived from the habitat restoration and sediment remediation measures expected to be employed in this project. The results of the HEP analysis and the wetland functional assessment suggest that the proposed restoration projects will make a substantive environmental improvement.

Temporary local effects to water quality are expected during all restoration and remediation activities. Sediments will be released to the water column during the dredging of contaminated bottom sediments at Scuffletown Creek, excavation activities at previously filled wetlands, and the placement of fill materials in shallow water areas to create the elevations necessary for intertidal wetland development. Efforts will be made to minimize the resuspension and transport of sediments during construction activities. The long-term benefits of the project to water quality in the Elizabeth River basin are expected to greatly exceed the temporary impacts. The wetland restoration projects will result in improved water quality by increasing the wetland acreage available to filter sediments and contaminants from stormwater runoff and non-point source discharges. The sediment remediation project at Scuffletown Creek will eliminate a source of contaminants this is currently contributing to the decline of water quality in the watershed and potentially causing acute and chronic toxicity to ecological receptors.

In many of the wetland restoration projects, habitat that is currently in the form of upland, degraded high marsh dominated by *Phragmites*, and shallow water habitat will be converted to low saltmarsh containing *Spartina* sp. Most of the upland sites and degraded high marsh sites, with the possible exception of Woodstock Neighborhood Park, are fill areas that historically supported emergent saltmarsh. The shallow water habitat that currently dominates the ODU drainage canal site receives large inputs of sediment laden stormwater runoff and is expected to be degraded due to the presence of runoff-derived contaminants. Creation of an emergent wetland at the mouth of the canal will provide water quality and habitat benefits that do not currently exist. Shallow water habitat that will be converted to wetland through filling at the Jordan Bridge is most likely contaminated with industrial contaminants from nearby wood treating facilities. The creation of wetlands at the Jordan Bridge will provide a net benefit to the local aquatic community by covering contaminated sediments and increasing the runoff filtering capacity of the embayment. Approximately 250 square feet of emergent marsh at Carolanne Farms will be excavated to establish a tidal connection between the restored marsh and nearby marshes. However, the project will result in a net increase of one acre of tidal emergent wetland."

10.0 SUMMARY OF EFFECTS

Section 122 of the River and Harbor and Flood Control Act of 1970 (P.L. 91-611) identifies some social, economic, and environmental effects that must be evaluated before undertaking the proposed restoration project. The following environmental categories must be addressed, and anticipated project effects on these environmental parameters must be evaluated. The Scuffletown sediment removal and wetland restoration sites are discussed separately when necessary.

AIR QUALITY

Dredging and Wetlands Restoration

Operation of heavy construction equipment would generate associated exhaust fumes in the immediate vicinity of the construction activity. This would not be expected to be a significant adverse air quality impact. Some minor volatilization of contaminants would occur during the dredging and handling of dredged material. Canopy cover measures would significantly reduce volatilization of contaminants during handling and transport.

The proposed project in its entirety, both the dredging in Scuffletown Creek and wetlands restoration on the eight proposed sites has been evaluated under the Clean Air Act (CAA) Amendments of 1990. The conformity determination considered for direct and indirect effects results in a conclusion that all the potential air emissions caused during the dredging of Scuffletown Creek and restoring the eight wetland sites are safely below the final rule de minimus levels and results in a record on non-applicability (RONA). A full-scale CAA conformity determination, therefore, will not be done. The action would comply with Section 176(c)(1) of the CAA Amendments of 1990.

NOISE

Dredging

The use of heavy equipment associated with dredging and placement for transport in trucks or scows on site would likely increase noise levels in the area during the construction period. Proposed dredging sites at Scuffletown Creek are near Jordan Bridge, a city park, and current and formal industrial areas. There is little residential development near any of the proposed dredging sites in Scuffletown Creek. Due to the lack of residential development in the area, the noise should be largely unnoticed. While some noise may be noticed by citizens at the city park at the mouth of Scuffletown Creek, this impact should be minimal.

Wetlands Restoration

The eight proposed wetland restoration sites lie in different areas. Some of them lie in or near undeveloped areas or industrial sites. The construction activities associated with grading or filling these sites, transporting the native plants, and planting them should have no noise impacts on local people or businesses. At these sites, local wildlife may be disturbed by the noise and presence of heavy construction vehicles and equipment while the construction is ongoing. Due to the current low wildlife value of these sites, the construction noise levels would disturb only small numbers of local fauna, and only for a brief time.

Other sites do border developed, residential areas. These include the Carolanne Farms Park, Woodstock Neighborhood Park, Grandy Village, and Lancelot Drive wetland restoration sites. Best management practices will be observed in order to minimize noise levels and conduct operations during normal business hours only, when most of the local citizens will be either at work or in school. Wildlife may be temporarily disturbed or displaced due to the noise and presence of heavy vehicles and equipment.

However, there should be no long-term negative impacts to local fauna due to a brief period of increased noise on these sites during the wetland restoration phase of the proposed sites.

WATER QUALITY

Dredging

A temporary increase in turbidity and small decrease in dissolved oxygen levels is expected during the dredging operations. Sediments are primarily silts, clays, and fine sands. Small amounts of contaminants associated with the sediments may be resuspended during dredging operations. It is likely small amounts of contaminants will be resuspended and transported from Scuffletown Creek downstream and into the Elizabeth River, which already has a significant contaminant burden in its sediments virtually throughout it's length. However, special measures will be taken to minimize sediment suspension and transport away from the construction site. These measures include using types of dredges known for their ability to minimize sediment suspension during operation, should help minimize effects. Due to these preventative measures, the small amount of transported sediments and their associated contaminants should not cause a measurable increase in contaminant levels in the Elizabeth River.

The dredging equipment and transportation scows rely on large combustion engines for power. There is a small chance for a fuel spill from any of this equipment, due to an accidental rupture of a fuel tank or line or a spill while refueling. A spill kit will be present during operations to contain any small spills that may occur.

Wetlands Restoration

During the excavation or filling for the restoration of the eight proposed sites, it is possible that the heavy construction equipment will impact the vegetation in the surrounding areas. This may result in some areas, in particular vehicle trails, becoming denuded of all vegetation. The potential for erosion of sediments into nearby waters during rain events exists. Management practices will be implemented which should minimize any direct impacts from vehicle operations on surrounding waters (See

Mitigation). It should also be noted that a fuel spill kit would be on site to contain any vehicle fuel spills to prevent fuel from washing into local waters in the event of an accident. All due care will be taken during the excavation and/or filling. Silt screens will be used as necessary to contain any loose sediments during this phase of the operation. Any sediments washed into the local waterways should be minimal and cause only a temporary increase in turbidity.

MANMADE AND NATURAL RESOURCES

Dredging

No manmade structures would be removed during the dredging of Scuffletown Creek, with the possible exception of debris in the channel. The proposed project would not remove any private or commercial oyster or clamming grounds. Although some recreation shellfish harvesting may take place, these shellfish are currently condemned for direct taking due to contaminant levels.

Wetlands Restoration

No manmade structures would be removed during the restoration of the eight wetland sites. Sites that may have had an impact on manmade structures were removed from consideration. Where manmade structures are present, such as trails or boat launches, they have been incorporated into the design of the restored wetland. In some cases, additional trails and park benches will be added to the site as part of the design.

ESSENTIAL FISH HABITAT

According to the 1996 Amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), EFH (Essential Fish Habitat) conservation must be encouraged and enhanced when possible. Several estuarine and marine fish species may be found in the proposed restoration areas in the Elizabeth River. The National Marine Fisheries Service (NMFS) has indicated by letter dated June 7, 2001 that, "…the proposed dredging of contaminated sediments could adversely impact juvenile fish, including anadromous fish species…Pursuant to Section 305(b)(4)(9A) of the MSFCMA, we offer the following Conservation Recommendation: that no dredging take place from February 15 through June 30, to reduce any potential adverse impacts from the proposal."

The NMFS conclusion that the proposed dredging would adversely affect Essential Fish Habitat (EFH) is not substantiated. The proposed dredging will take place in a secluded creek off the main stem of the Southern Branch of the Elizabeth River and will be performed with equipment and in such a manner that suspended sediment in the water column will be minimized and retained within a relatively isolated area. EFH will be positively and beneficially affected by reducing bottom sediment toxicity, improving benthic community abundance and diversity, and reducing the existing incident of fish cancers, lesions, and abnormalities.

Removing contaminated sediments from Scuffletown Creek will enhance fisheries habitat by reducing physiological stress and increasing numbers of benthic organisms, many of which are food sources for fish found in the area, such as spot, summer flounder, windowpane flounder, and anadromous fish species. Restoring the wetland sites should also provide positive benefits to EFH by enhancing water quality and providing additional food, spawning, and nursery areas for fishes in the area. Therefore, based upon the conclusion of this EA that EFH would not be adversely affected, the conservation recommendation that no dredging take place from February 15 through June 30 will not be enforced.

AESTHETIC RESOURCES

Dredging

Dredging Scuffletown Creek should not have any adverse aesthetic impact. While the river bottom is not visible, there will be improved public perception of this being a cleaned and restored area which will be a positive benefit. The placement of sediments, either in dredge disposal sites or regulated landfills should not have any significant visual impact upon these sites.

Wetlands Restoration

Restoring the eight wetland sites should not have any negative aesthetic impact, except possibly during the construction/excavation phase. Excavation will occur for a relatively brief period of time depending on site size. The long term benefits of removing rubble and low quality vegetation such as common reed, installing walking trails, and restoring wildlife and wetlands to their natural conditions with native vegetation should significantly improve the aesthetics of the local area and outweigh this possible short term negative effect caused by the excavation.

COMMUNITY COHESION

Dredging and Wetlands Restoration

No significant negative impacts to community cohesion are expected as a result of restoring the eight wetland sites although there may be some minor opposition by local residents. This opposition would be based, to a large extent, on the perception of wetlands as sources or locations of mosquitoes, snakes, trash, and other features undesirable to them. Residents have also expressed other concerns, such as local drainage problems, during discussions of the various sites. As the public coordination and involvement process continues, some of these concerns may be reduced or eliminated.

With construction of the wetland areas, the strong community support that has developed for some of the sites would likely enhance those communities where this has occurred. The improved appearance of the areas and the enhanced recreational potential would contribute to the positive impact on the community.

Wetlands Restoration

No significant negative impacts are expected to community cohesion as a result of restoring the eight wetland sites. Commercial and recreational watermen should benefit from the restored wetlands and the associated fisheries benefits. Recreational users will benefit from the proposed trails, and increased opportunities for such activities as hiking and bird watching throughout the improved habitat.

PUBLIC FACILITIES AND SERVICES

Dredging

The city park and boat ramp nearby may be temporarily affected by the proposed dredging and dredged material handling operations. A temporary disruption in services may be experienced during construction. No permanent adverse impacts are anticipated.

Wetlands Restoration

Several of the proposed wetland sites to be restored lie in public parks. These sites are not currently high use areas, and no significant reduction in the public's ability to access or use the parks is expected. In the Woodstock Neighborhood Park site in Virginia Beach, the site to be restored is currently a sand and gravel pit. Other sites, such as the Portsmouth City Park site, were wetlands prior to filling. Currently, erosion has exposed construction rubble fill material at the shoreline of the site. Restoring these sites should improve their access and appearance to the public. At several of the proposed restoration sites, installation of additional hiking trails, park benches, and connections to present recreational facilities should significantly improve the public facilities and services at the sites.

EMPLOYMENT EFFECTS

Dredging and Wetlands Restoration

Both aspects of the project are not expected to change long-term employment opportunities but may increase short-term employment as a result of construction activities.

TAX AND PROPERTY VALUES

Dredging

No adverse impacts are expected in tax and property values. Due to removal of contaminated sediments and increased navigability, property adjacent to Scuffletown Creek may increase in value.

Wetlands Restoration

No adverse impacts are expected. Due to removal of debris, rubble, and low quality, low wildlife value vegetation, and installation of mulched walking trails, park benches, and connections to other recreational sites, property adjacent to some of the wetland restoration sites may increase in value.

OTHER SOCIAL EFFECTS

Dredging and Wetlands Restoration

Neither dredging nor wetland creation will require any commercial or residential relocations. Since all the property involved in the wetland creation is public, no private property will be affected by this portion of the project. No significant effect on local growth is anticipated from the project. The potential sites for both dredging and wetland creation are all located in heavily developed areas. The improvement of the areas through wetland creation may stimulate some redevelopment in adjacent property, but overall the effect on regional growth would be minimal.

COASTAL ZONE RESOURCES

The Coastal Zone Resources Management Act (CZMA) of 1972, as amended, establishes a policy: 1) to preserve, protect, develop and, where possible, restore and enhance the resources of the Nation's coastal zone; and 2) to encourage and assist states in their responsibilities in the coastal zone through development and implementation management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and esthetic values, as well as the needs for compatible economic development (16 U.S.C 1452).

CZMA delegates responsibility to coastal states to exercise their duties as owners of coastal zone areas to develop and implement management programs to achieve sensible use of the land and water resources. The CZMA acknowledges the state as the best level for developing a comprehensive coastal zone management program and Virginia is one of 24 states with an approved CZM program administered by the Virginia DEQ. The Secretary of Commerce is authorized to award Federal grants to assist states in developing and administering management programs.

In accordance with the CZMA of 1972, as amended, and the approved Coastal Zone Management Program (VCP) of the Commonwealth of Virginia, the proposed dredging for sediment clean-up and associated dredged material placement, and wetlands restoration has been evaluated for consistency with coastal development policies. Based upon a preliminary assessment of probable impacts, and the proposition that the proposed projects will enhance and restore the Nation's coastal zone resources, the proposed actions appear to be consistent with the approved VCP of Virginia. In a letter to the Corps from DEQ dated April 30, 2001, they stated that *"...Based on the consistency determination (Draft EA, page 58) that the Corps will obtain and comply with all approvals from agencies administering the applicable enforceable policies, as well as the foregoing comments and analysis, we concur with the finding that this proposed project is consistent with the VCP."*

MITIGATION

AVOIDANCE

The proposed dredging in Scuffletown Creek was designed to avoid impacts to the greatest extent practicable. No significant impacts are expected with the project, all shellfish beds, SAV, and other concentrations of natural resources near the dredging sites lie outside the proposed project area. No public or private access areas or facilities that are within the proposed project area will be negatively affected. Access to any present facilities should be improved within the project area.

MINIMIZATION

A number of measures will be implemented during the dredging to minimize impacts. Dredges selected for use will be those that suspend minimal amounts of sediments. Watertight scows and/or trucks will be used to transport the sediments from the site, and will not be overfilled to prevent spilling any sediments during the trip to the disposal site.

For the wetlands restoration sites, all best management practices (BMPs) possible will be employed to minimize any impacts. Vehicles will not be operated during periods of high erosion potential, such as during or immediately after storm events, types of tires on the vehicles will be those designed to lessen their impact on wetland soils, timber matting and rock will be placed as needed to provide vehicle access to sites, minimize impacts to soils, and removed when the construction is completed.

COMPENSATION

No compensatory mitigation will be required to complete the proposed dredging of contaminated sediments in Scuffletown Creek or to complete the restoration of the proposed eight sites to fully functional wetlands. There will be a net gain of approximately eighteen acres of vegetated wetlands with the proposed construction.

11.0 PUBLIC INVOLVEMENT

PUBLIC CONCERN AND PLANNING OBJECTIVES

Four local citizens conceived a non-profit organization, the Elizabeth River Project (ERP), in 1991. Their premise: *This river's large problems will not be solved by government alone, but by a new level of community stewardship.* In 1994, they steered 80 volunteers from many different backgrounds through a seven-month process of analysis and debate leading to agreement on the river's worst problems. A 120-member Watershed Action Team began work in 1995 researching and developing papers on these problems. A Watershed Action Plan was developed addressing the "high risk" problems of sediment contamination, habitat loss, point source and non-point source pollution. The plan achieved consensus in 1996 and specific follow-up actions were chosen based on three criteria: effectiveness, affordability, and acceptability. Since 1996 the ERP, now over 500 members strong, has been implementing specific restoration projects and initiatives which address these critical areas.

The Commonwealth of Virginia and the cities of Chesapeake, Norfolk, Portsmouth and Virginia Beach, along with the ERP, have become partners with the COE to work together to restore the Elizabeth River to its highest practical level. From the consensus achieved by the work of the ERP, sediment remediation and wetlands restoration have been identified as the two major thrusts of this restoration initiative.

A Steering Committee of these sponsors, along with other state and Federal agencies, academia, and citizens began working with the COE in 1997 to identify high-visibility sites in the river with known contamination and historical wetland areas that could be cleaned up and restored. In July 1998, the Commonwealth and these cities formally initiating this feasibility investigation signed a cost-sharing agreement with the COE.

During the Reconnaissance study, the Norfolk District first met in February 1997 with field-level representatives of local sponsors including Chesapeake, Norfolk, Portsmouth, Virginia Beach, the Commonwealth of Virginia, DEQ, and the ERP to discuss the expedited reconnaissance schedule and process. A follow-up meeting was conducted with city managers and state and congressional representatives in March 1997. From these and other designated representatives, a steering committee was then assembled to meet on a monthly basis to share information, target potential projects, and discuss funding issues.

During the Feasibility study phase, the steering committee has continued to meet monthly to make decisions about study direction and progress. Two separate technical subcommittees were formed by the Steering Committee to address the two broad areas of investigation: wetlands restoration and sediment restoration. These subcommittees meet regularly to make technical decisions about data acquisition and interpretation, study direction and project design proposals. The technical subcommittees then make recommendations to the Steering Committee for approval.

The ERP has joined with the COE and the non-Federal sponsors to give this project wide visibility and opportunity for input from the public. Most of the wetland restoration initiatives have been presented to local civic groups. Aspects of the proposed sediment restoration project at Scuffletown Creek was presented to the public at the Elizabeth River Project's State of the River Conference on April 28, 2000.

A Sediment Restoration Advisory Committee (Sed RAC) has been formed to address community and stakeholder concerns; inform community and stakeholders; and build support for sediment clean-up. The Sed RAC is comprised of Federal, State, and local agencies as well as civic leagues and local citizen groups. There were two meetings of the Sed RAC in 2000.

As part of public involvement, the final Feasibility Report and final EA will be made available to the public for review and comment and will be coordinated with appropriate Federal, State, and local agencies. The final EA and associated Finding of No Significant Impact (FONSI) will also be made available to the public.

13.0 ENVIRONMENTAL LAWS, STATUTES AND EXECUTIVE ORDERS

Coordination with the USFWS has to date yielded no formal consultation requirements pursuant to Section 7 of the Endangered Species Act. With implementation of management recommendations, they do not indicate that any of the proposals which are being recommended would adversely impact any endangered species or their habitat, as specified by the Endangered Species Act of 1973, as amended, or any other significant resources.

The proposed project has been evaluated under the CAA Amendments of 1990. The conformity determination considered direct and indirect effects and has concluded that the air emissions relevant to the proposed construction activities are safely below the final rule's *de minimus* levels. A full-scale CAA conformity determination, therefore, will not be performed. The action would comply with Section 176(c)(1) of the CAA Amendments of 1990.

A Section 404(b)(1) Evaluation (Public Law 92-500, as amended) has been prepared for both wetland restoration and sediment clean-up and these appear at the end of this assessment. The evaluations describe the impact to water quality as required by the CWA. Water quality may be temporarily impacted by construction, but all necessary precautions would be taken in order to minimize this impact. A Virginia Water Protection Permit under Section 401 of the CWA, as amended, will be applied for and obtained from VDEQ prior to construction.

The relationship of the proposed project to various environmental requirements and protection statutes is summarized in the following narrative.

COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

1. Preservation of Historic and Archaeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: The State Historic Preservation Officer (SHPO) and the Virginia Department of Historic Resources (DHR) have been coordinated with concerning historic and/or archaeological resources in the project area. Continued coordination with DHR and the SHPO, where required, signifies compliance.

2. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Submission of this EA to the Regional Administrator of the Environmental Protection Agency for review pursuant to Sections 176(c) and 309 of the Clean Air Act signifies compliance.

3. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972 and Water Quality Act of 1987) PL 100-4, 33 U.S.C. 1251 et seq.

Compliance: A Section 404(b)(1) Evaluation and Compliance Review have been incorporated into this report. An application will be filed for a Virginia Water Protection Permit pursuant to Section 401 of the Clean Water Act.

4. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1431 et seq.

Compliance: Submission of this document to the Virginia Department of Environmental Quality, Office of Environmental Impact Review, and the Virginia Marine Resources Commission, the state agencies which oversee Coastal Zone Management (CZM), and their issuance of applicable permits and a Federal Consistency Determination signifies compliance.

5. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the F&WS and National Marine Fisheries Service (NMFS) signifies compliance. F&WS participated in project development and site visits. Section 7 consultation was initiated via letter to F&WS and NMFS. No ESA species or their habitat would be adversely impacted in the proposed project areas. Both agencies will be provided copy of Final EA for information.

6. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Coordination of this document with appropriate Federal and state resource agencies signifies compliance with this act.

7. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Coordination with the National Park Service (NPS) and the Virginia Department of Conservation and Recreation, relative to the Federal and state comprehensive outdoor recreation plans signifies compliance with this act.

8. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the F&WS, NMFS and Virginia Department of Game and Inland Fisheries signifies compliance with this act.

9. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Submission of this report to the NPS and the Virginia Department of Conservation and Recreation relative to the Federal and state comprehensive outdoor recreation plans signifies compliance with this act.

10. Marine Protection, Research, and Sanctuaries Act of 1972, as amended 33 U.S.C. 1401 et seq.

Compliance: Not applicable; project does not involve the transportation or placement of dredged material in ocean waters pursuant to Sections 102 and 103 of the Act, respectively.

11. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the SHPO and the Department of Historic Resources and their response indicates that the proposed project will have no adverse effect on historic properties. Agency concurrence with the findings of this EA will signify further compliance and no impact.

12. National Environmental Policy Act of 1969, as amended, 42 U.S.C. 432 et seq.

Compliance: Preparation of this EA and public coordination and comment signifies partial compliance with NEPA. Full compliance is noted with the signing and issuing of the Finding of No Significant Impact (FONSI).

13. Rivers and Harbors Appropriation Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: Exempt.

14. Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 et seq.

Compliance: Project has been evaluated in reference to this act. The proposed project would not adversely impact any component of the Virginia Scenic Rivers System. Coordination with the NPS and the Virginia Department of Conservation and Recreation, relative to the Virginia Scenic Rivers System and their letter of response to the Final EA signifies compliance with this act.

15. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC 9601-9675.

Compliance: Project has been evaluated in reference to this act. No evidence indicates that there are any hazardous substances on terrestrial or subaqueous lands necessary for project construction, operation, and maintenance. Project is in compliance with this act following state and Federal agency concurrence with the findings of this EA.

Executive Orders

1. Executive Order 11988, Floodplain Management, 24 May 1977, as amended by Executive Order 12148, 20 July 1979.

Compliance: The proposed project would not stimulate development in the flood plain. Circulation of this report for public review fulfills the requirements of Executive Order 11988, Section 2(a)(2).

2. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Impacts to wetlands have been avoided to the greatest extent practicable. Tidal wetlands will be restored, protected and/or created with implementation of the proposed project. Circulation of this report for public review fulfills the requirements of Executive Order 11990, Section 2(b).

3. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not applicable; project is located within the United States.

4. Executive Order 12898, Environmental Justice in Minority Populations and Low-Income Populations, 11 February, 1994.

Compliance: No impacts are expected to occur to any minority or low-income communities. A public notice will be issued in a local newspaper. This final EA will be made available for comment to all individuals who have an interest or may be affected by the proposed project.

Executive Memorandum

1. Analysis of Impacts of Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: There would be no adverse impact to prime or unique agricultural lands with the implementation of the proposed project.

14.0 SUMMARY AND CONCLUSIONS

The conclusions of this assessment are based on an evaluation of the effects that the actions summarized above would have on the human environment as well as study area ecosystems including the land, air, and water systems of the Elizabeth River and vicinity.

There is no known information that would indicate a potential for the project, as proposed, to cause any long-term adverse environmental effects within the project vicinity.

Shellfish resources will not be impacted by construction of the project. Commercially exploitable concentrations of oyster resources in the Elizabeth River are not present in the project areas. Finfish resources, whether commercial or sport oriented, are not expected to be adversely affected by project activities. There will be long-term benefits to fish and wildlife resources from habitat restoration associated with both sediment clean-up and wetland restoration.

There will be some conversion of one wetland type to another associated with wetland restoration. Some mud flats and shallow water at the receiving ends of major stormwater outfalls will be converted to vegetated intertidal wetlands. There will be a conversion from *Phragmites* sp. (common reed) dominated wetlands to *Spartina alterniflora* dominated wetlands at several sites. Rubble filled former wetlands will be restored to their former state.

Due to the dynamic environment of the study area, aquatic organisms are constantly adapting to changes caused by the natural forces of winds, waves, currents, and tides. In addition, there are man-induced disturbances such as boat traffic which routinely cause resuspension of sediments in the river. Water quality impacts caused by construction for wetland restoration and sediment removal would be temporary and short-lived and are not expected to exceed natural or man-induced disturbances; therefore, no significant long-term effects are anticipated.

The conclusions of this assessment are based on an evaluation of the effects that the proposed action would have on the total ecosystem including the land, air, and water resources of the Elizabeth River watershed. Implementing the preferred alternative which includes sediment clean-up at Scuffletown Creek and wetland restoration at eight sites in the river would not have a significant adverse impact on the environment. Conversely, these restoration projects are expected to contribute significantly to environmental quality improvements. Design features and best management practices have been incorporated into the project which would minimize impacts to existing riparian, wetland, open water, and benthic habitat. The effect of the proposed action would not be environmentally controversial.

An Environmental Impact Statement (EIS) will not be required because of lack of significant adverse effects, and long term beneficial ecosystem restoration effects.

15.0 COORDINATION

As part of the NEPA process, this final EA will be provided to (at least) the following Federal, State, and local agencies/organizations for review and comment. Public input will be considered in the scope of final impact analyses in the EA. The Finding of No Significant Impact (FONSI) will be made accessible for public review through mailings and notification by the use of local media.

Federal
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
Natural Resources Conservation Service

Federal continued:
U.S. Coast Guard
U.S. Geological Survey
National Park Service

Commonwealth of Virginia
Virginia Marine Resources Commission
Department of Environmental Quality
Department of Conservation and Recreation
Department of Agriculture & Consumer Services
Department of Game and Inland Fisheries
Department of Historic Resources
Department of Health
Department of Transportation
Department of Forestry
Department of Mines, Minerals, and Energy
Department of Emergency Services
Chesapeake Bay Local Assistant Department
Virginia Institute of Marine Science

Local/Other
City of Norfolk
City of Portsmouth
City of Chesapeake
City of Virginia Beach
Elizabeth River Project
Association for the Preservation of Virginia Antiquities
Hampton Roads Planning District Commission

REFERENCES

(See accompanying feasibility report for complete list of references.)

SECTION 404(b)(1) EVALUATION
Wetlands Restoration
Elizabeth River, Virginia

I. Project Description

a. Location – Eight sites, Elizabeth River, Virginia (Plate EA-1)

b. General Description - Wetland restoration involves either removal of fill material to attain intertidal salt marsh elevations, grading and planting; and/or depositing clean fill material, building an elevation for intertidal salt marsh, grading, and planting. In higher wave energy environments, protective features such as rock sills will be constructed.

c. Authority and Purpose – Study authorized by a resolution dated 14 September 1995 of the House Committee on Transportation and Infrastructure.

d. General Description of Dredged or Fill Material – Clean and coarse-grained fill material.

e. Description of the Proposed Discharge Site

(1) Location (map) - See Plate EA-1

(2) Size – Total restored area(s) = approx. 18 acres

(3) Type of site – Upland; intertidal; and shallow water

(4) Type of habitat – Upland and aquatic

(5) Timing and duration of discharge – Excavation of upland and/or placement of clean fill in intertidal zone to create bench for building wetland may take place at any time of the year, for a duration of up to several months at each of 8 sites.

f. Description of Placement Method – Excavated upland materials will be truck hauled and placed into appropriate landfill site; deposited coarse grained materials will be placed by either truck or barge to build bench in intertidal zone. Placed materials will be vegetated with native wetland plant species.

II. Factual Determination

a. Physical Substrate Determinations

(1) Substrate elevation and slope - Semi-confined intertidal and shallow open water

(2) Sediment type - Predominantly sand.

(3) Dredged/fill material movement - Minor

(4) Physical effects on benthos - Loss of benthos at placement site for wetland bench. Long term benefits would be realized with construction of the proposed wetland sites.

(5) Other effects - Minor and short-term changes

(6) Actions taken to minimize impacts - None required

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water. Consider effects on:

(a) Salinity - No effect

(b) Water chemistry - Minor and temporary effect on dissolved oxygen (DO) and biological oxygen demand (BOD) during construction; temporary turbidity increase

(c) Clarity - Minor and temporary turbidity may be generated during construction.

(d) Color - Minor and temporary change due to turbidity

(e) Odor - No change

(f) Taste - No change

(g) Dissolved gas levels - Minor and temporary reduction in dissolved oxygen

(h) Nutrients - Minor and temporary increase

(i) Eutrophication - No change

(j) Temperature - Minor or no changes anticipated

(k) Others as appropriate - None

(2) Current patterns and circulation

(a) Current patterns and flow - No effect anticipated

(b) Mean velocity - No effect anticipated

(c) Stratification - No change

(d) Hydrologic regime - Estuarine, no change

(3) Normal water level fluctuations - No change

(4) Salinity gradients - No change

(5) Actions that would be taken to minimize impacts – Build low-profile sills seaward of constructed wetland bench to contain placed materials.

c. Suspended Particulates/Turbidity Determinations

(1) Expected changes in suspended particulates and turbidity levels - Minor and temporary during construction

(2) Effects (degree and duration) on chemical and physical properties of the water column - Temporary during construction

(a) Light penetration - Minor decrease during construction; temporary effect

(b) Dissolved oxygen - Minor decrease during construction; temporary effect

(c) Toxic metals and organics - None present; no effect

(d) Pathogens - None present; no effect

(e) Aesthetics - Minor degradation during construction; some temporary disturbance of natural conditions but overall improvement in presently degraded areas.

(3) Effects on biota

(a) Primary production, photosynthesis - Temporary increase in suspended solids would reduce light transmission and photosynthesis. Long term benefits would be realized with construction of the proposed wetland sites.

(b) Suspension/filter feeders - Would be temporarily affected by minor increase in suspended solids

(c) Sight feeders - Would be temporarily affected by minor increase in suspended solids

(4) Actions taken to minimize impacts - None

d. Contaminant Determinations - Bottom sediments in several of the project area(s) where wetlands will be created in shallow water are suspected to have contaminants derived from storm water drainage and adjacent industry. These would be capped with clean, coarse-grained fill material to build wetland bench.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on plankton - Would be temporarily affected by increases in suspended solids. Long term benefits would be realized with construction of the proposed wetland sites.

(2) Effects on benthos - Loss of benthos at construction site

(3) Effects on nekton - Would be temporarily affected by increase in suspended solids and minor disturbance to benthic feeding areas.

(4) Effects on aquatic food web - Would be temporarily affected by minor loss of benthos and increase in suspended solids in water column. Long term benefits would be realized with construction of the proposed wetland sites.

(5) Effects on special aquatic sites

(a) Sanctuaries and Refuges - None affected

(b) Wetlands - No effect

(c) Mudflats – Some loss of mudflats to construct wetlands.

(d) Vegetated shallows - None present at site(s)

(e) Riffle and pool complexes - N/A

(6) Threatened and endangered species - No impact

(7) Other wildlife - Resident wildlife (i.e., aquatic life) may be disturbed temporarily. Long term improvements in wetland wildlife habitat feeding, spawning, and nursery areas.

(8) Actions to minimize impacts - None

f. Proposed Disposal Site Determinations

(1) Mixing zone determinations

(a) Depth of water - At shallow water construction site: 0-3 feet; average 2.5 feet

(b) Current velocity – Elizabeth River wetland site(s) = av. 1 to 2 f.p.s.

(c) Degree of turbulence - Negligible

(d) Stratification - Negligible

(e) Discharge vessel speed and direction - N/A

(f) Rate of discharge - N/A

(g) Placed material characteristics (to build wetland bench) - > 90% Sand

(h) Number of discharge actions per unit time - N/A

(2) Determination of compliance with applicable water quality standards - All applicable water quality standards will be complied with.

(3) Potential effects on human use characteristic

(a) Municipal and private water supply - Proposed project would not affect municipal or private water supply.

(b) Recreational and commercial fisheries - Short-term and minor turbidity increases and minor impact to benthos from construction would minimally affect fisheries. Recreational and commercial fishing vessels will not be impacted by construction of wetlands.

(c) Water-related recreation - No impact

(d) Aesthetics - No impact, proposed improvements would improve aesthetic quality of Elizabeth River and vicinity

(e) Parks, national and historical monuments, national seashores, wilderness areas, etc. - None affected

g. Determination of Cumulative Effects on the Aquatic Ecosystem - The proposed project involves construction of approx. 18 acres of intertidal wetlands.

Most (15 ac.) will be constructed by excavating upland fill materials. The remainder would be created by placing coarse grained material in shallow water to build a wetland bench. Cumulatively, construction activities may have a more pronounced impact than they do separately. Some benthic habitat will be disturbed/lost with construction. Aquatic organisms will feed, spawn in, and inhabit wetlands. Long term benefits would be realized with construction of the proposed wetland sites.

h. Determination of Secondary Effects on the Aquatic Ecosystem - None anticipated

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

A. The evaluation of the proposed wetland restoration projects in the Elizabeth River, Virginia was made consistent with 404(b)(1) Guidelines.

B. The proposed plan was selected because of its ability to meet the ecosystem restoration goals and objectives of the Federal Government and the local sponsor(s), and because the environmental impacts associated with the recommended plan were comparable to impacts associated with other alternatives. There were several alternatives evaluated in the final array as described in the accompanying EA. The recommended plan was selected based on its acceptability from an environmental, social, and economic perspective.

C. The planned construction of these wetlands in the Elizabeth River would not violate any applicable state water quality standards. A 401 Virginia Water Protection Permit will be applied for and would be obtained prior to construction. There would be a short-term increase in suspended solids in the water column during construction. Construction activities would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

D. Use of the selected sites for construction would not harm any endangered species or their critical habitat.

E. The proposed construction would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Effects on aquatic ecosystem diversity, productivity, and stability would be limited and localized; significant adverse impacts to recreational, aesthetic, and economic values would not occur. Long term benefits would be realized with construction of the proposed wetland sites.

F. Appropriate steps would be taken to minimize potential adverse impacts to aquatic systems resulting from construction activities.

G. On the basis of the guidelines, the proposed sites for construction restored wetlands is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

SECTION 404(b)(1) EVALUATION
Sediment Clean-Up (Environmental Dredging)
Scuffletown Creek
Elizabeth River, Virginia

I. Project Description

a. Location – Scuffletown Creek, Elizabeth River, Virginia (Plate EA-2)

b. General Description - Sediment restoration involves environmental dredging, transport of dredged material by barge or truck, permanent placement in a dredged material placement site; and/or temporary placement, treatment, and permanent placement in a regulated landfill.

c. Authority and Purpose – Study authorized by a resolution dated 14 September 1995 of the House Committee on Transportation and Infrastructure. Purpose is to clean-up contaminated river bottom sediments to improve/restore aquatic organism health, abundance, and diversity.

d. General Description of Dredged or Fill Material – Predominantly fine silts and clays, some sand. Contaminants including metals and organics present.

e. Description of the Proposed Discharge Site (Upland Placement Area)

(1) Location (map) - See Plate EA-1

(2) Size – 20 to 30 acres

(3) Type of site – Upland

(4) Type of habitat – Previous dredged material site and upland borrow pit

(5) Timing and duration of discharge – Dredging of sediments within Scuffletown Creek and placement in a confined upland site may take place at any time of year, for a duration of up to 6 to 12 months.

f. Description of Placement Method – Dredged materials will be excavated by dredge and will be transported by either truck or barge and placed into appropriate dredged material and/or landfill site.

II. Factual Determination

a. Physical Substrate Determinations

(1) Substrate elevation and slope - Semi-confined intertidal and shallow open water

(2) Sediment type - Predominantly silts and clays.

(3) Dredged/fill material movement - Minor

(4) Physical effects on benthos - Loss of benthos at dredging site.

(5) Other effects - Minor and short-term changes

(6) Actions taken to minimize impacts - None required

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water. Consider effects on:

(a) Salinity - No effect

(b) Water chemistry - Minor and temporary effect on dissolved oxygen (DO) and biological oxygen demand (BOD) during construction; temporary turbidity increase

(c) Clarity - Minor and temporary turbidity may be generated during construction.

(d) Color - Minor and temporary change due to turbidity

(e) Odor - No change

(f) Taste - No change

(g) Dissolved gas levels - Minor and temporary reduction in dissolved oxygen

(h) Nutrients - Minor and temporary increase

(i) Eutrophication - No change

(j) Temperature - Minor or no changes anticipated

(k) Others as appropriate - None

(2) Current patterns and circulation

(a) Current patterns and flow - No effect anticipated

(b) Mean velocity - No effect anticipated

(c) Stratification - No change

(d) Hydrologic regime - Estuarine, no change

(3) Normal water level fluctuations - No change

(4) Salinity gradients - No change

(5) Actions that would be taken to minimize impacts – Specialized dredging equipment

c. Suspended Particulates/Turbidity Determinations

(1) Expected changes in suspended particulates and turbidity levels - Minor and temporary during construction

(2) Effects (degree and duration) on chemical and physical properties of the water column - Temporary during construction

(a) Light penetration - Minor decrease during construction; temporary effect

(b) Dissolved oxygen - Minor decrease during construction; temporary effect

(c) Toxic metals and organics – Both present; short term effect related to dredging and removal; removal of contaminated sediments will have long term beneficial effect on water quality

(d) Pathogens - None present; no effect

(e) Aesthetics - Minor degradation during construction; some temporary disturbance of natural conditions but overall improvement in presently degraded areas.

(3) Effects on biota

(a) Primary production, photosynthesis - Temporary increase in suspended solids would reduce light transmission and photosynthesis; removal of contaminated sediments will have long term beneficial effect

(b) Suspension/filter feeders - Would be temporarily affected by minor increase in suspended solids; removal of contaminated sediments will have long term beneficial effect

(c) Sight feeders - Would be temporarily affected by minor increase in suspended solids; removal of contaminated sediments will have long term beneficial effect

(4) Actions taken to minimize impacts – Specialized equipment

d. Contaminant Determinations – Both organics and metals in bottom sediments exceed sediment quality criteria.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on plankton - Would be temporarily affected by increases in suspended solids; removal of contaminated sediments will have long term beneficial effect

(2) Effects on benthos - Loss of benthos at construction site; removal of contaminated sediments will have long term beneficial effect in restoring community abundance, diversity and health.

(3) Effects on nekton - Would be temporarily affected by increase in suspended solids and minor disturbance to benthic feeding areas. Removal of contaminated sediments will have long term beneficial effect.

(4) Effects on aquatic food web - Would be temporarily affected by minor loss of benthos and increase in suspended solids in water column. Removal of contaminated sediments will have long term beneficial effect throughout the food web.

(5) Effects on special aquatic sites

(a) Sanctuaries and Refuges - None affected

(b) Wetlands - No effect

(c) Mudflats – Some possible minor loss of mudflats.

(d) Vegetated shallows - None present at dredging site(s)

(e) Riffle and pool complexes - N/A

(6) Threatened and endangered species - No impact

(7) Other wildlife - Resident wildlife (i.e., aquatic life) may be disturbed temporarily. Long term improvements in fish and wildlife habitat feeding, spawning, and nursery areas.

(8) Actions to minimize impacts - None

f. Proposed Disposal Site Determinations

(1) Mixing zone determinations

(a) Depth of water – Ranges from 2 to 6 feet; average 2.5 feet

(b) Current velocity – Elizabeth River wetland site(s) = av. 1 to 2 f.p.s.

(c) Degree of turbulence - Negligible

(d) Stratification - Negligible

(e) Discharge vessel speed and direction - N/A

(f) Rate of discharge - N/A

(g) Placed material characteristics – N/A

(h) Number of discharge actions per unit time - N/A

(2) Determination of compliance with applicable water quality standards - All applicable water quality standards will be complied with.

(3) Potential effects on human use characteristic

(a) Municipal and private water supply - Proposed project would not affect municipal or private water supply.

(b) Recreational and commercial fisheries - Short-term and minor turbidity increases and minor impact to benthos from construction would minimally affect fisheries. Recreational fishing vessels may be temporarily disturbed during construction. Removal of contaminated sediments will have long term beneficial effect on both fisheries.

(c) Water-related recreation - No impact

(d) Aesthetics - No impact, proposed project to remove contaminated sediments would improve aesthetic quality of Elizabeth River and vicinity

(e) Parks, national and historical monuments, national seashores, wilderness areas, etc. - None affected

g. Determination of Cumulative Effects on the Aquatic Ecosystem - The proposed project involves removal of approximately 60,000 cubic yards of sediment. A portion of this sediment is contaminated with elevated levels of both organics and metals. Removal of contaminated sediments will have long term beneficial effect on the aquatic ecosystem.

h. Determination of Secondary Effects on the Aquatic Ecosystem - None anticipated

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

A. The evaluation of the proposed environmental dredging in Scuffletown Creek, a tributary to Southern Branch of the Elizabeth River, Virginia, was made consistent with 404(b)(1) Guidelines.

B. The proposed plan was selected because of its ability to meet the ecosystem restoration goals and objectives of the Federal Government and the local sponsor(s), and because the environmental impacts associated with the recommended plan were comparable to impacts associated with other alternatives. There were several alternatives evaluated in the final array as described in the accompanying EA. The recommended plan was selected based on its acceptability from an environmental, social, and economic perspective.

C. The planned construction of this project in Elizabeth River would not violate any applicable state water quality standards. A 401 Virginia Water Protection Permit will be applied for and would be obtained prior to construction. There would be a short-term increase in suspended solids in the water column during construction. Construction activities would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

D. Use of the selected sites for construction would not harm any endangered species or their critical habitat.

E. The proposed construction would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Effects on aquatic ecosystem diversity, productivity, and stability would be limited and localized; significant adverse impacts to recreational, aesthetic, and economic values would not occur. Long-term environmental benefits would be realized with environmental dredging as proposed.

F. Appropriate steps would be taken to minimize potential adverse impacts to aquatic systems resulting from construction activities.

G. On the basis of the guidelines, the proposed site for environmental dredging is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

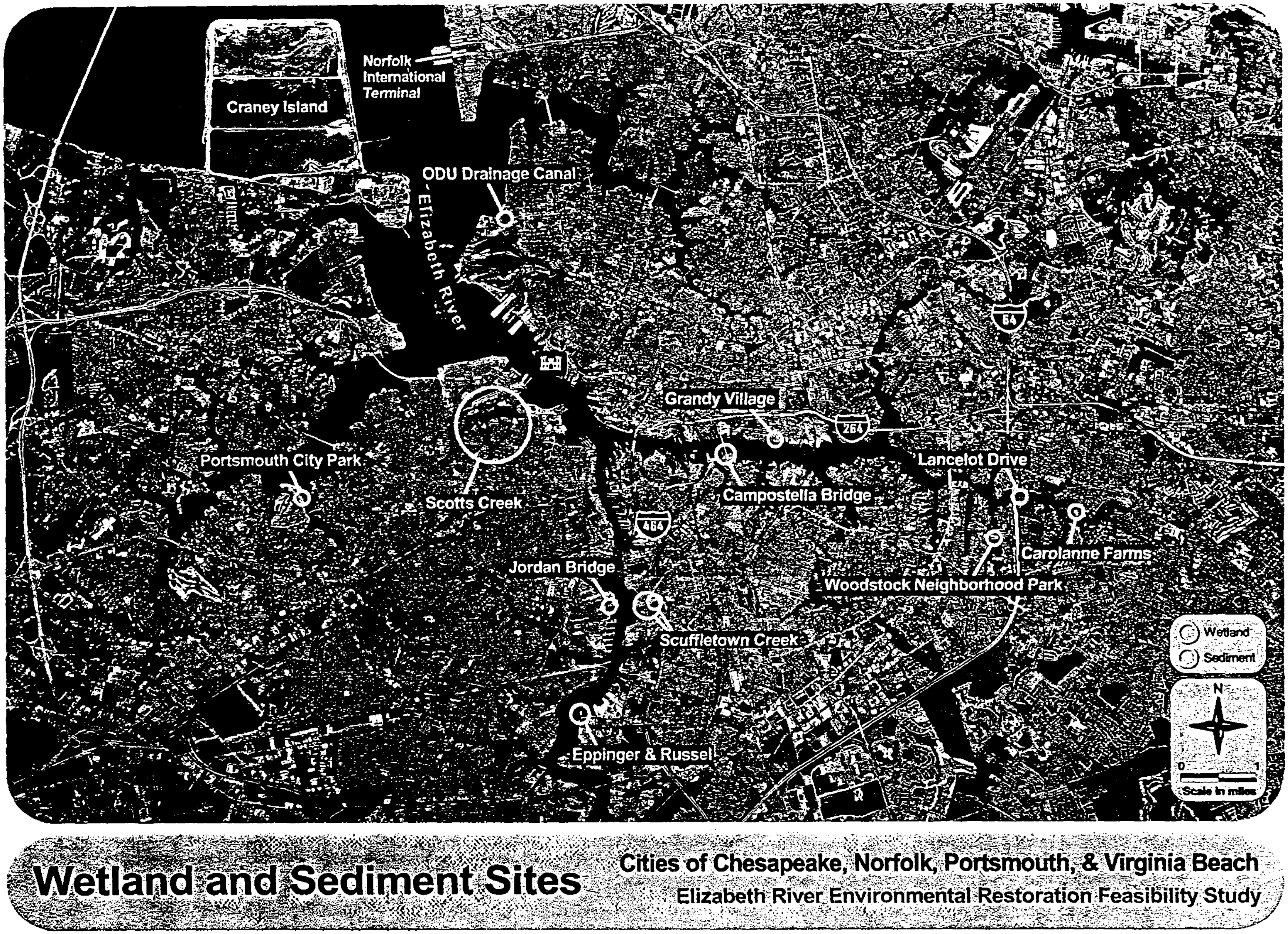


PLATE EA-1 - SEDIMENT AND WETLAND RESTORATION SITES

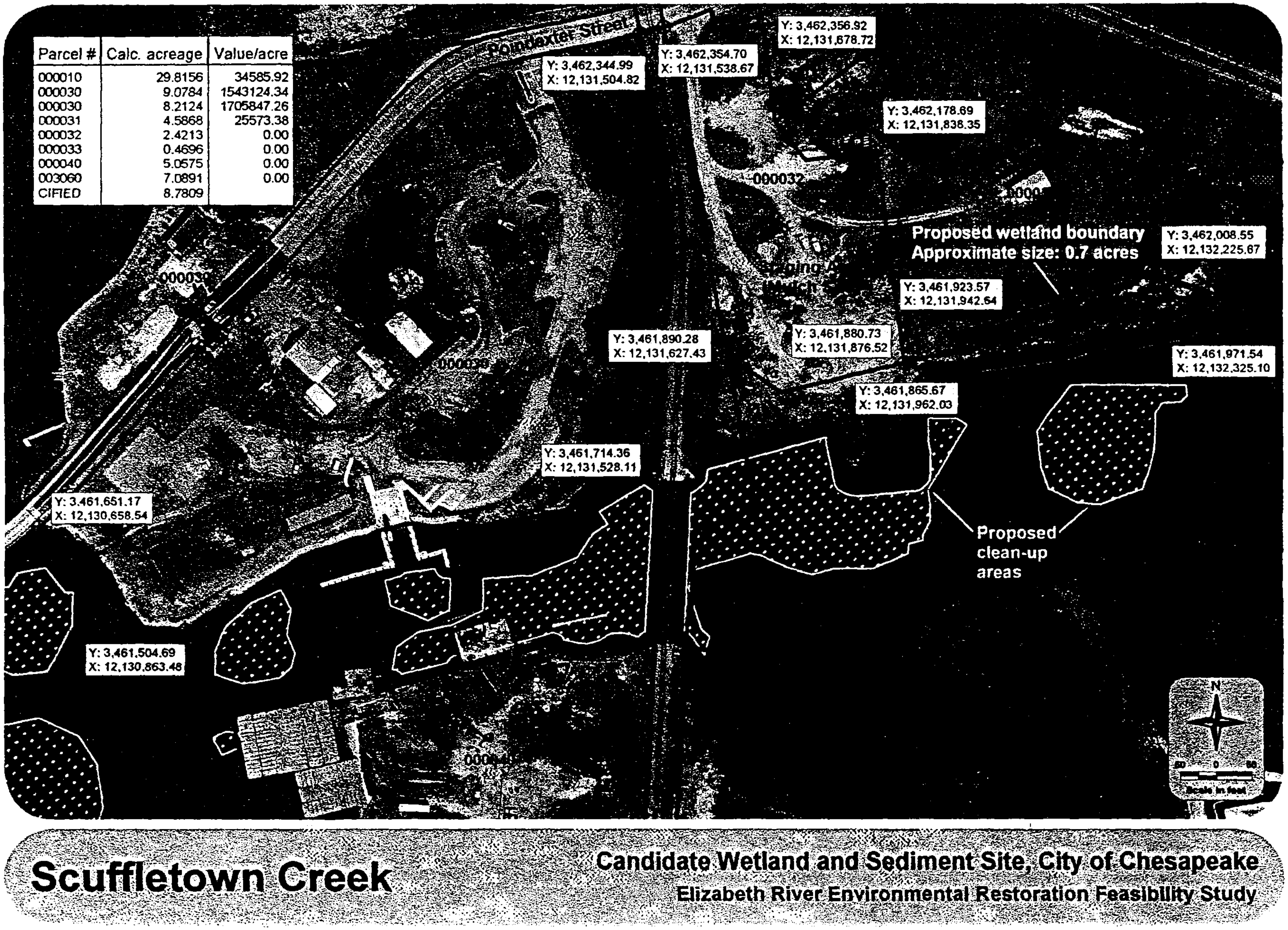


PLATE EA-2 - SCUFFLETOWN CREEK

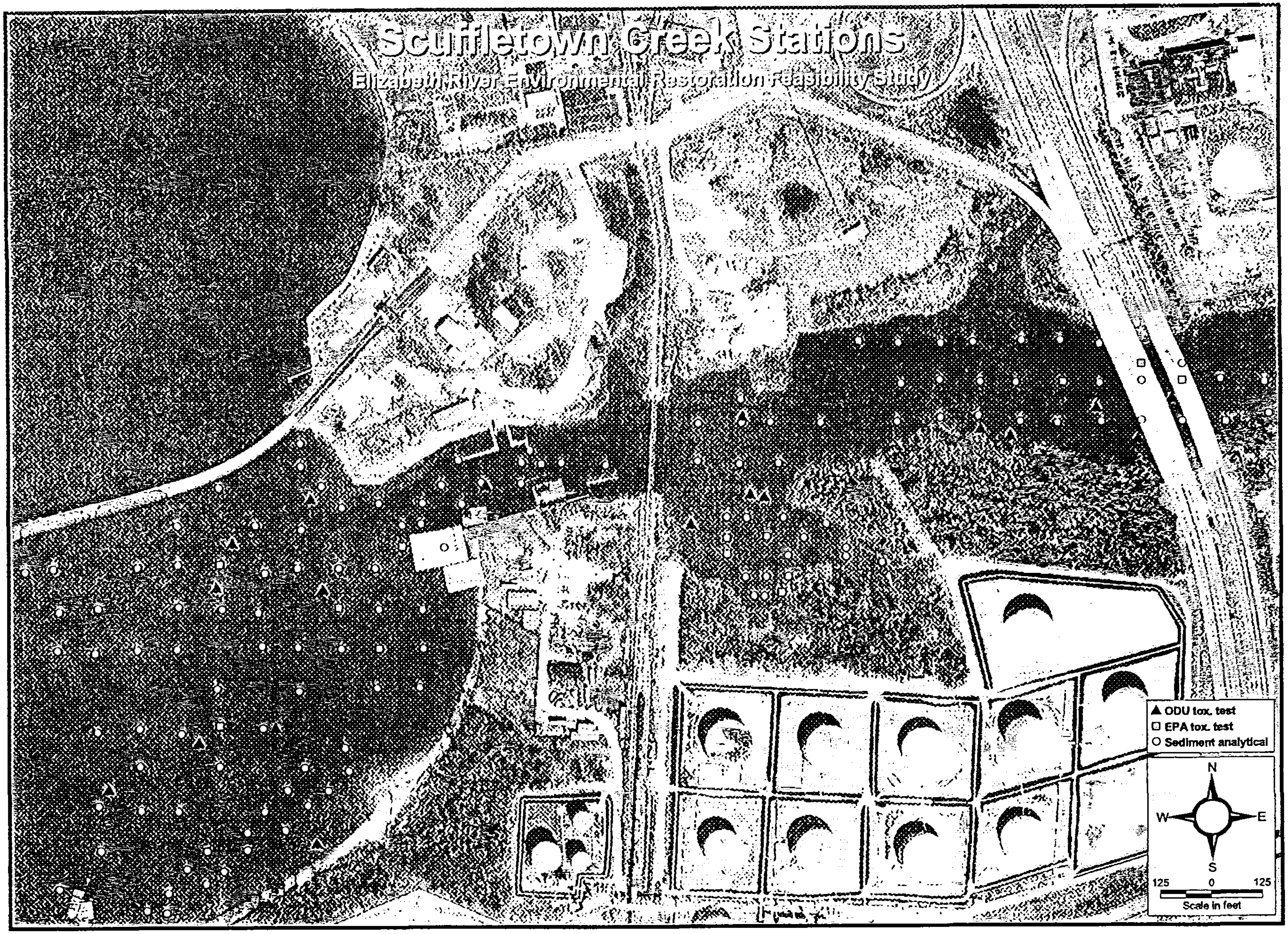


PLATE EA-3 - SEDIMENT SAMPLING SITES: SCUFFLETOWN CREEK

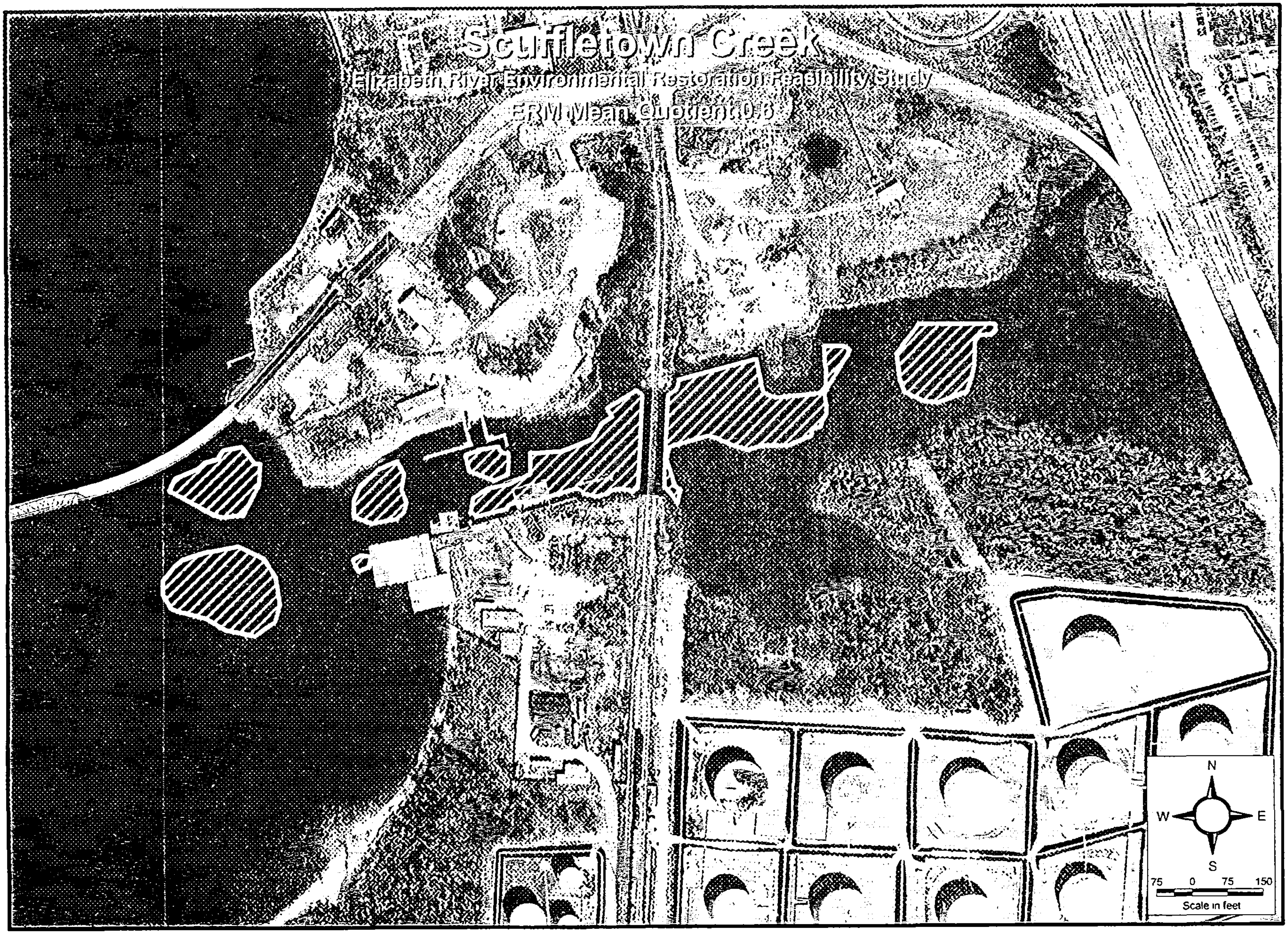


PLATE EA-4 - 0.6 ERM SQV CONTOUR MAP

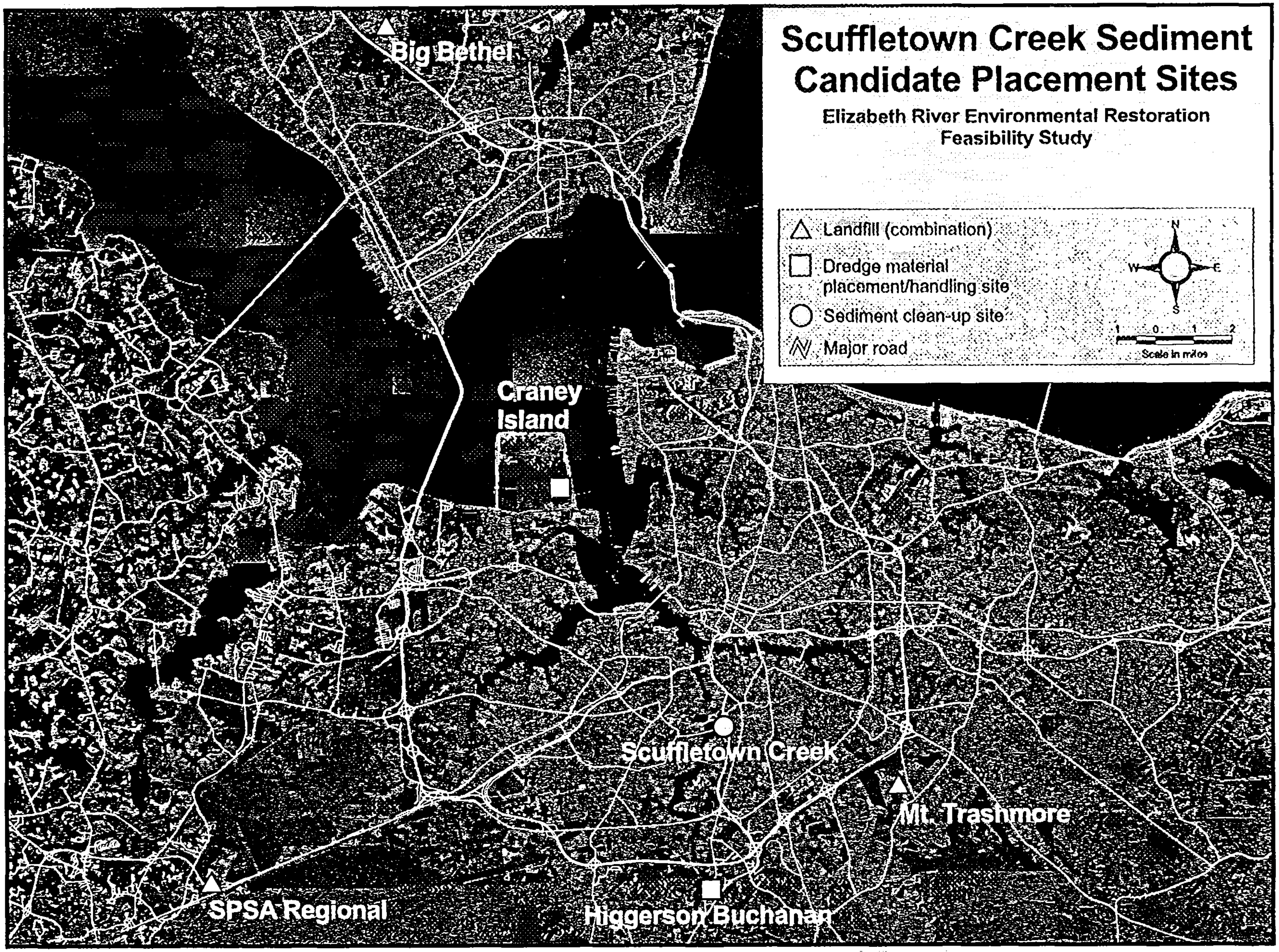


PLATE EA-5 - DREDGED MATERIAL PLACEMENT SITES
AND LANDFILL SITES


City of Virginia Beach Wetland Sites
Elizabeth River Environmental Restoration Feasibility Study
Lancelot Drive
Carolanne Farms
Woodstock Neighborhood Park
Site boundary
N
W
E
S
200 0 200 400
Scale in feet

PLATE EA-6

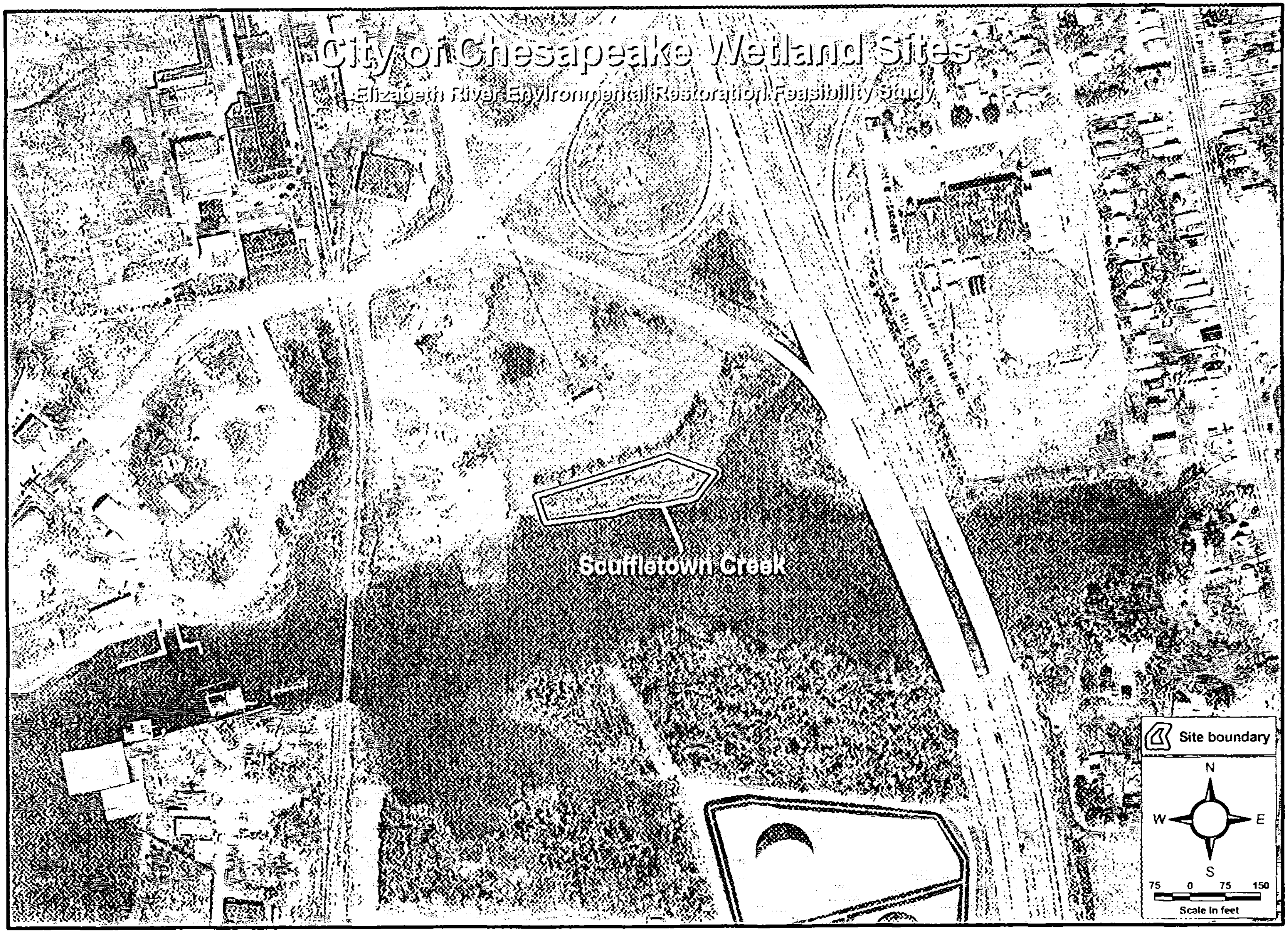
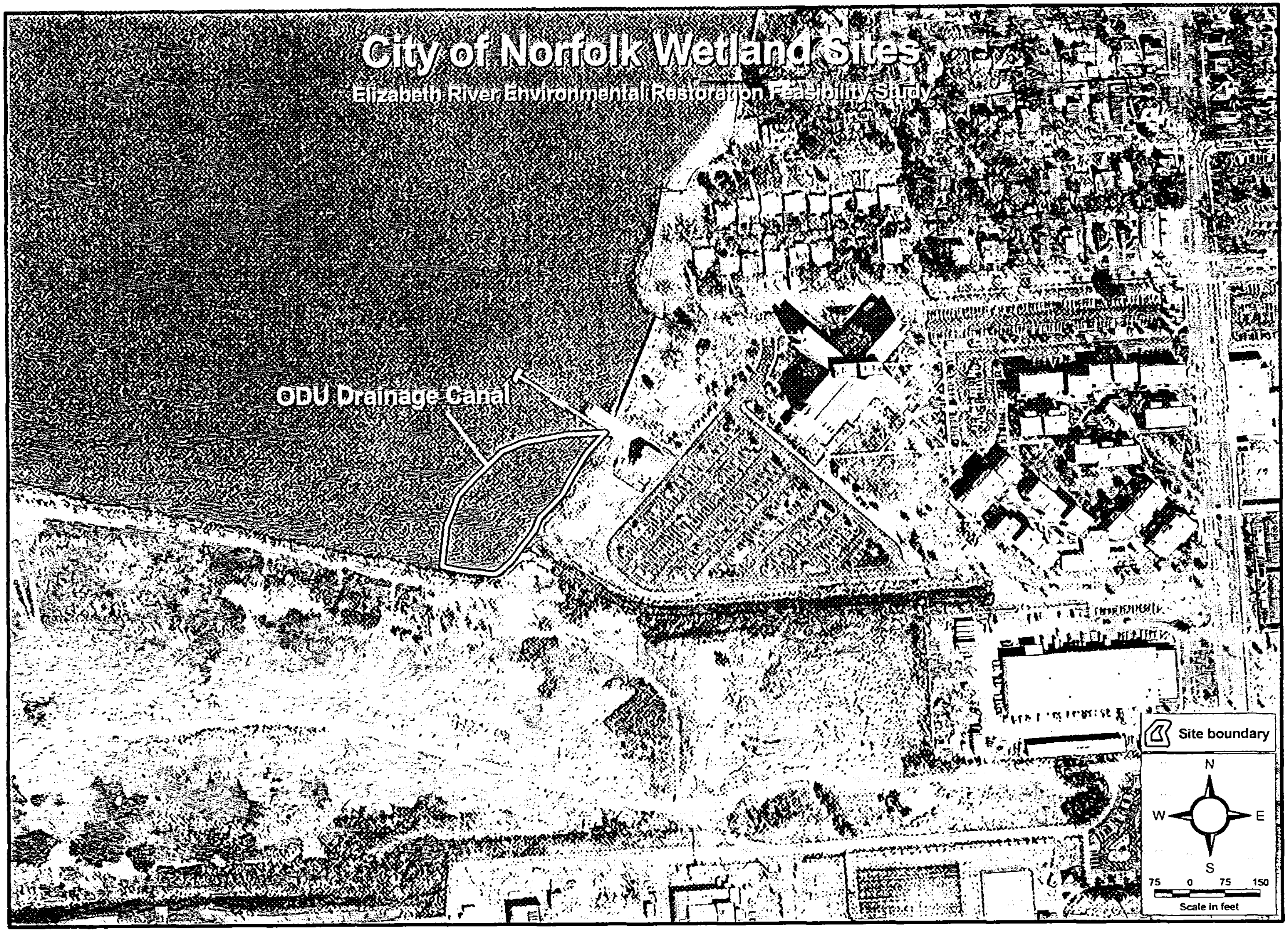

City of Chesapeake Wetland Sites
Elizabeth River Environmental Restoration Feasibility Study
Scuffletown Creek
Site boundary
N
W
E
S
75 0 75 150
Scale in feet

PLATE EA-8

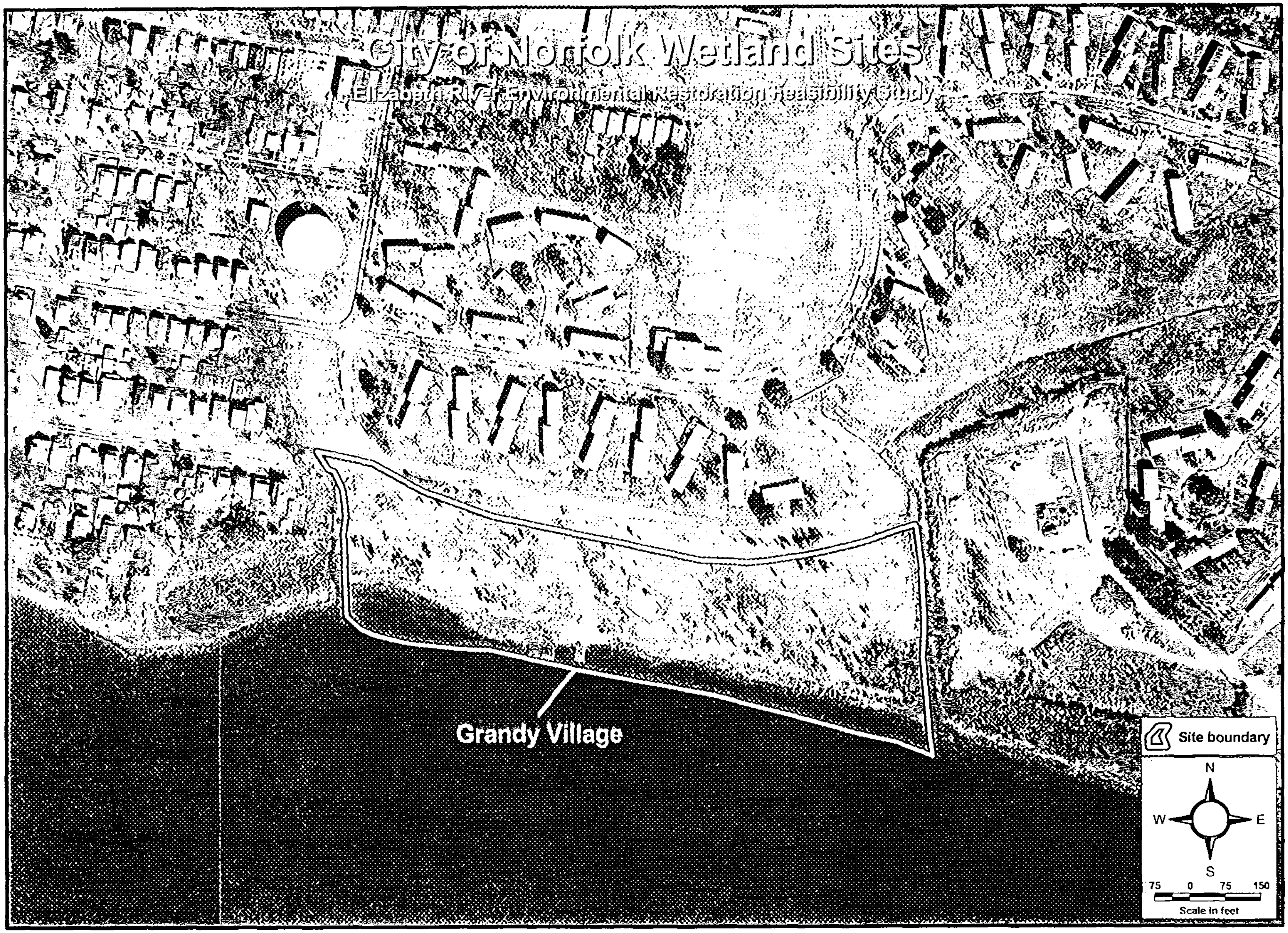
PLATE EA-9


City of Norfolk Wetland Sites
Elizabeth River Environmental Restoration Feasibility Study
ODU Drainage Canal
Site boundary
N
W
E
S
75 0 75 150
Scale in feet


City of Portsmouth Wetland Sites
Elizabeth River Environmental Restoration Feasibility Study
Portsmouth City Park
Site boundary
N
W
E
S
75 0 75 150
Scale in feet

PLATE EA-10

PLATE EA-11


City of Norfolk Wetland Sites
Elizabeth River Environmental Restoration Feasibility Study
Grandy Village
Site boundary
N
W
E
S
75 0 75 150
Scale in feet

APPENDICES

APPENDIX 1

U.S. FISH & WILDLIFE SERVICE DRAFT AND FINAL COORDINATION ACT REPORTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

April 30, 2001

Colonel Allan B. Carroll
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Craig Seltzer

Re: Elizabeth River Environmental Restoration

Dear Colonel Carroll:

This constitutes the Final Report of the U.S. Fish and Wildlife Service (Service) on Norfolk District Corps of Engineer's (Corps) proposed environmental restoration project for the Elizabeth River in the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia. It is submitted in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat 884, as amended; 16 U.S.C. 661 *et seq*) and Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). The purpose of this report is to present an evaluation of the project alternatives and to set forth the Service's official position on the recommended project as described in the Draft Feasability Study and Draft Environmental Assessment dated March 2001, the Formulation Analysis Notebook dated September 2000, the Project Study Plan dated July 1998, and other project-related documents. The Service previously submitted a Draft Fish and Wildlife Coordination Act Report dated November 2000.

INTRODUCTION

The Elizabeth River watershed encompasses approximately 300 square miles within the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia. A tidal tributary to the Chesapeake Bay, the Elizabeth River has become heavily impacted by industrial and urban development over the years resulting in many environmental problems Three hundred years of industrial pollution have made the Elizabeth River one of the most polluted rivers in the United States. Over the years, stormwater runoff, point source discharges, and spills from commercial, industrial, and military sources have contaminated river sediments and lowered water quality Industrial and urban development and related filling activities have destroyed many wetland habitats on the river. Only a fraction of the original wetlands remain to support wildlife and filter storm water runoff, the greatest source of pollution to the river. It has been estimated that as much as 50 percent of the tidal wetlands in the Elizabeth River basin were lost between 1944 and 1977 (Priest and Hopkins 1997). In 1993, the Chesapeake Bay Program identified the Elizabeth River as one of the three Regions of Concern where contaminants pose the greatest threat to natural resources.

The Commonwealth of Virginia and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, and the non-profit Elizabeth River Project have partnered with the Corps to restore the Elizabeth River to the greatest extent practical. The specific area addressed by the project includes the Elizabeth River and its major tributaries including the Lafayette River, Eastern Branch, Southern Branch, and Western Branch. The restoration project has identified contaminated sediment remediation and wetland restoration as the two major project goals.

PROJECT DESCRIPTION

The Corps has recently completed a feasibility study that evaluated 19 wetland restoration sites and 5 sediment remediation sites within the Elizabeth River watershed for possible inclusion in the project.

Wetland Restoration

In the initial stages of the feasibility investigation for wetland restoration, eight of the original 19 sites were eliminated from further consideration. Sites were eliminated for the following reasons: private property issues; space constraints resulting from the presence of buildings, roads, or utilities; potentially contaminated landfills on-site; former industrial sites with contaminated soils; the presence of desirable mature wooded habitat on-site; and stormwater management issues. The remaining 11 sites were subjected to cost effectiveness analysis, incremental cost analysis, and environmental benefits analysis using two assessment methodologies: the Service's Habitat Evaluation Procedures (HEP) and a wetlands functional assessment. The size of wetland habitats currently existing on the sites ranges from 0.03 to 2.9 acres. Wetland acreages on the restored sites are expected to range from 0.33 to 7.0 acres. Total wetland acreage will be increased from 4.9 to 18.2 acres.

The HEP method, originally developed by the U.S. Fish and Wildlife Service (USFWS 1980), assesses the suitability of habitat conditions for selected species in a study area before and after impacts on a project site and before and after restoration of mitigation sites. The HEP procedure accounts for both the quality and quantity of habitat by multiplying the areal extent of habitat under consideration by a numerical habitat suitability index (HSI) for a given evaluation species. The HSI value varies from 0.0 to 1.0 (0.0 represents no value and 1.0 represents optimal habitat) and is multiplied by acreage to yield habitat units (HU) for each evaluation species. Habitat units are a quantitative expression of environmental output, with one HU being equivalent to one acre of optimum habitat a given evaluation species.

The HEP for the Elizabeth River Project was performed by personnel from the Corps, the Service, and the Virginia Institute of Marine Science. Due to the complexity and effort involved in using the original USFWS HEP procedures, the procedures were streamlined and tailored to meet individual objectives for this project evaluation. Specific adaptations which were agreed upon in the present study include: 1) use of "typical" conditions at each site in lieu of strict delineation of habitat cover types; 2) deliberate selection of species that would benefit from saltmarsh restoration; 3) use of only one evaluation species; and 4) relaxation of the minimum habitat size criterion for the species. We believe this approach is appropriate, as we are using the one evaluation species as a surrogate for many salt marsh-dependent species of wildlife and because we are only evaluating restoration projects. This would not be an acceptable approach if construction impacts and mitigation were being evaluated.

For the baseline habitat evaluation, site visits were conducted in October 1998 and November 1999. Topographic surveys, aerial photos, and wetland delineation maps also were used to evaluate the baseline and post- restoration field parameters associated with the HEP model. Initially, several avian, mammalian, and fish evaluation species were selected based on restoration concepts and availability of species models. However, it soon became apparent that few of the models accurately reflected conditions at the restoration sites. For example, the muskrat model, developed for fluvial conditions, undervalued the tidal marsh habitats being evaluated for the project. The marsh wren (*Cistohorus albus*), yellow crown night heron (*Nyctanassa violacea*), great egret (*Casmerodius albus*), juvenile spot (*Leiostomus xanthurus*) and croaker (*Micropogon undulatus*) were also considered but the models were not appropriate for the river and shoreline conditions in the urban and industrial sites proposed for restoration. After eliminating inappropriate species models, the team decided to limit the HEP analysis to one avian species, the clapper rail (*Rallus longirostris*). The clapper rail has multiple life requisite factors (food, cover, breeding, and water) within the proposed emergent marsh restoration sites. The HEP models consider individual life requisite factors based on several conditions that must be considered together in order to evaluate the individual life requisite. For example, the "food/cover" life requisite for the clapper rail is based on three habitat variables: percentage of wetland shoreline that borders flat to gently sloping banks or tidal flats exposed at low tide; percentage of total area that is salt or brackish emergent or scrub/shrub wetlands; and percentage of area of emergent or scrub/shrub wetlands within 15 meters of tidally influenced water bodies.

Using the Clapper Rail model (Lewis and Garrison 1983), a HSI was calculated for baseline and restored conditions at each proposed restoration site. The HSI was then multiplied by site acreage to yield the number of habitat units supplied by each scenario (Table 1). Habitat units for baseline conditions at the sites ranged from 0 to 1.83 while the range of habitat units for the restored sites increased to 0.33 to 5.9. For each site, the number of habitat units expected to occur in the future without restoration was subtracted from the number of habitat units to occur in the future with restoration to obtain the benefits due to site restoration. Benefits with restoration ranged from 0.26 to 4.1 habitat units.

The second methodology employed to assess the environmental benefits of each of the alternative restoration sites was a wetlands functional assessment score. The concept behind the functional assessment is to capture the range of beneficial functions provided by wetlands systems, such as the capacity of wetlands to produce plant material to support aquatic food chains, to provide fish and wildlife habitat, to improve water quality, to reduce shoreline erosion, and help reduce shoreline flooding, and to improve community aesthetics and provide educational opportunities. A panel of subject matter experts (composed of biologists from the Corps, the Service, and the Virginia Institute of Marine Science) developed a functional numerical index in which the values recorded for each of seven wetlands functions were assigned a score of between 1 (low) to 5 (high) to describe how well each wetland site performs a specific function. The wetland functions considered include: 1) primary production, measured by organic production, decomposition, and availability of plant material as food to aquatic organisms; 2) fish and wildlife habitat, as measured by tidal regime, ratio of cover to open water, ratio of shoreline to wetland area, and cover type diversity; 3) water quality, characterized by watershed area, detention time, width of wetlands, percent cover, and stormwater features; 4) erosion buffer, as measured by vegetative cover type, width of marsh, slope of marsh, and elevation of marsh; 5) flood buffer, measured by storm tide volume and floodplain width; 6) aesthetics, characterized by "greenspace" availability, existing degradation, and site visibility; and 7) public accessibility and educational value, characterized by accessibility of site, proximity to schools and neighborhoods, and recreational opportunities.

The expert panel judged the existing condition, the expected future without -project condition, and the expected future with project conditions for the 11 alternative restoration sites, on the 1 to 5 scale for each of the seven measurements of wetlands functions. The seven separate functional index scores were weighted equally and then summed to provide a more complete representation of how well each wetland site contributed across wetland functions. The highest possible score (a score of 5 for all seven functions) was calculated to be a score of 35. Functional scores at each site were then multiplied by acreage at that site to reflect the fact that the functional benefits provided would be proportional to the size of the wetlands. This proportionality technique is analogous to the habitat unit concept, in which both quality and quantity are important factors in the determination of environmental outputs. Projected scores at each site ranged from 0 to 60.9 for the without-project future condition and increased to 8.58 to 231.0 for the with-project future condition (Table 2). Expected functional scores under each alternative restoration site were compared to the expected future without-project score (and the difference calculated) to yield an overall numerical value of wetlands improvement or benefit. The value of overall wetland improvements ranged from 7.06 to 170.1.

The habitat unit benefits and the numerical functional scores were converted to average annual equivalents by linear interpolation to account for the fact that full ecosystem benefits are not expected to occur until the third post-restoration year of the 50-year project analysis period (Table 3). These values were then factored into the cost effectiveness and incremental cost analyses. Cost analysis resulted in the elimination of three more sites where a large jump in cost was required to achieve a relatively small benefit in the form of restored habitat. As a result, eight of the original 19 candidate wetland restoration projects totaling 18.2 acres of restored emergent wetland remain under consideration (Table 4; Figure 1).

The projects will consist of the creation or enhancement of tidal emergent salt marsh habitats through grading, filling, and planting. In general, the restored marshes will contain a natural progression (from low marsh to high marsh) of saltmarsh cordgrass (*Spartina alterniflora*), salt meadow hay (*Spartina patens*), marsh elder (*Iva frutescens*), groundsel tree (*Baccharis halimifolia*), and wax myrtle (*Myrica cerifera*).

Many of the sites contain upland fringe areas that afford the opportunity to plant warm season grasses such as deer tongue (*Dichanthelium clandestinum*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon virgatum*), and switch grass (*Panicum virgatum*). These grasses provide important food and cover habitat for wildlife. Periodic mowing (once during second growing season, once every three years thereafter) of warm season grass plantings is necessary to reduce annual weed invasion and allow light to penetrate to the warm season grass seedlings. Upon request, the Service will supply the Corps with a planting scheme for warm season grasses. At sites containing more expansive upland areas, trees with high wildlife value such as white oak (*Quercus alba*), black oak (*Quercus velutina*), willow oak (*Quercus phellos*), black cherry (*Prunus serotina*), and hackberry (*Celtis occidentalis*) can be planted. Trees should not be planted so close to the restored wetlands as to excessively shade the wetland plantings.

The descriptions of the individual projects, benefits, and site-specific U.S. Fish and Wildlife Service recommendations are described in detail below.

1) <u>Scuffletown Creek</u> - The site is located in Chesapeake on the north shore of Scuffletown Creek near its confluence with the Elizabeth River. The Scuffletown Creek project will convert a currently degraded fringe area dominated by rubble fill and containing only 0.08 acres of wetland dominated by *Baccaris hamifolia* and *Iva frutescens* into a 0.33 acre emergent fringe wetland that will connect two healthy wetland areas. The restoration of the site will consist of excavation of rubble and debris and replacement with soils that are suitable to support wetland vegetation. The site will be graded to the appropriate elevation and planted with the emergent vegetation described above.

Recommendations: The site is currently fringed by a thin forested area. This should be left in place to maintain habitat diversity at the site and to provide a buffer between the restored wetland and nearby degraded uplands. Major Benefits: reestablishes wetland habitat connectivity between two existing marshes; provides additional wildlife habitat and water buffering capacity.

2) <u>Grandy Village</u> - The Grandy Village site is named for a nearby public housing complex and is located in Norfolk on the north shore of the Eastern Branch of the

Elizabeth River. The site is currently dominated by a largely undeveloped upland fill area and supports approximately 2.9 acres of fringe saltmarsh along the river. Tidal guts occur at the eastern and western edges of the site. *Phragmites australis* is prevalent throughout the site. Historic information suggests that the site contained a series of small tidal creeks surrounded by salt marshes.

The restoration objective is to establish a wider saltmarsh fringe community and eradicate *Phragmites*. The restoration of this site will result in the return of the shoreline to the more irregular configuration that existed prior to filling. This will require excavation and removal of large quantities of material and regrading to create low marsh areas while increasing the available shoreline for new plantings. Wetland restoration will be designed around existing stands of vegetation and tree growth on the site and result in 7 acres of restored wetland habitat. The restored site will also contain walkways and bridges to allow for public access. The site plan calls for a variety of planting areas containing low marsh, high marsh fringe, upland fringes planted with shrubs, and the addition of trees to complement the pines, cedars, and willow currently existing on site.

Recommendations: The restoration of this site provides a significant opportunity to establish warm season grasslands in upland areas. A riparian forest should be created landward of the restored wetlands to provide a buffer from existing development. A grassland or shrub habitat (*Baccharis halmifolia*, *Iva frutescens*, and *Myrica* sp.) transition zone could be created between the forest and the wetland to increase habitat diversity and reduce the possibility of shading impacts. Soil amendments may be necessary to permit the establishment of vegetation in areas that are currently barren. It may be possible to use soils excavated from the site at other sites that require fill. The restored site would benefit from educational signage. Major Benefits: Creation of important wetland and shallow water habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish (including anadromous fish and other forage species) and wildlife (including waterfowl, wading birds such as the blue heron, song birds, and neotropical migrants); provides educational opportunities for the local community; provides additional water buffering capacity.

3) <u>Old Dominion University (ODU) Drainage Canal</u> - This site is located in Norfolk, on the west side of ODU, adjacent to the sailing center, at the mouth of the drainage canal on the mainstem of the Elizabeth River. The tidally influenced canal is approximately 1000 feet long and drains surface runoff from much of the campus. One side of the canal borders a landfill on Norfolk City property. The site currently consists of intertidal mudflat and supports approximately 0.03 acres of wetland habitat. The shoreline adjacent to the site consists mostly of rubble fill. The restoration design for this project consists of the creation of 0.6 acres of low marsh on the intertidal mudflat where the canal discharges into the river. The project will include the construction of a rock weir for water flow dissipation of discharge from the canal, sand fill to obtain the proper elevation for the plantings, and a low-crested rock sill for river generated wave dissipation.

Recommendations: Explore the opportunity of creating riparian habitat along the shoreline of the landfill by sloping fill material up against the existing embankment and planting trees. Good opportunity to use excavated material generated at other sites. This project provides an excellent opportunity for a student at ODU to perform a before and after study to document water quality benefits. Major Benefits: will benefit water quality by sequestering sediments and contaminants in runoff from a large surface area that is currently flowing unchecked into the Elizabeth River; creates additional fish and wildlife breeding, nursery, and foraging habitat; will aid in the control of shoreline erosion.

4) Portsmouth City Park - This site is located in Portsmouth on Bailey's Creek on the Western Branch of the Elizabeth River. A swale marks the location of one of the two wetland restoration projects on the site. The other project is located nearby in an erosional area on the banks of Bailey's Creek. Historic aerial photography shows that the swale was once a tidal creek and a fringe marsh once existed in the erosional area. Both areas currently contain fill material consisting of asphalt, concrete, brick, and rock and support approximately 0.16 acres of total wetland habitat.

The restoration design for the swale project consists of an excavated inlet, resulting in a shallow wetland pocket, surrounded by a much expanded wetland planting area. A large *Spartina alterniflora* fringe will be created by expanding the +0.5 to 2.4 foot elevations and fringing this with *Spartina patens* at slightly higher elevations and finally, an upland bench that will provide a protective buffer of shrubs. The construction will include a sediment trap to capture sediment laden runoff from nearby parking lots and filter runoff into the wetland. Existing mature trees including pines, hackberry, and cypress will be protected and augmented with additional species. A trail and foot bridge will traverse the wetland. A fringe marsh will be reestablished in the erosional area on Bailey's Creek, restoring the original connectivity of marsh habitat along the banks of the creek. Restored wetland habitats at the site will total 0.85 acres.

Recommendations: Expand upland buffer plantings to include warm season grasses. Due to its location in a city park, the site would benefit from interpretive signage. *Phragmites* control should be a part of this project. Major Benefits: will benefit water quality by sequestering sediments and contaminants in runoff from parking lots; creates additional fish and wildlife breeding, nursery, and foraging habitat; will aid in the control of shoreline erosion; will provide educational opportunities; will provide greater connectivity of fringe wetland habitat along Bailey's Creek.

5) Northwest Side Jordan Bridge - This site is located on the north side of the northwest end of the Jordan Bridge in Chesapeake. The site is near two former wood treating facilities that caused creosote laden runoff to contaminate aquatic sediments in the area. The site is currently a shallow embayment that is fringed with approximately 0.095 acres of emergent wetland habitat. The restoration of this site will mostly consist of the creation of low marsh habitat containing *Spartina alterniflora* by placing clean coarse-grained fill in the embayment to the proper elevation and then planting the area. A two to three-foot oyster shell breakwater will be constructed on the eastern edge of the

project to protect the wetland from erosion. This project will result in the creation of a total of 1.20 acres of wetland habitat at the site.

Recommendations: It will be important to include an erosion component in the monitoring and maintenance plan for this site. Major Benefits: clean and ultimately vegetated sediments will be placed over potentially contaminated sediments, reducing a contaminant pathway to ecological receptors; provides additional fish and wildlife breeding, nursery, and foraging habitat; provides additional water buffering capacity by filtering runoff from nearby industrial areas.

6) <u>Woodstock Neighborhood Park</u> - The site is located in Virginia Beach in a neighborhood park at the northern edge of a flooded borrow pit that is connected to the Eastern Branch of the Elizabeth River by a narrow cut. The site currently consists of mostly mowed upland with approximately 0.11 acres of emergent marsh at the edge of the borrow pit. The restoration project will result in an increase to 1.6 acres of wetland habitat by the conversion of upland habitat to wetland by regrading and planting. The resulting marsh will have a gradual slope following a low marsh, high marsh, upland buffer progression.

Recommendations: As with Grandy Village, this is a good opportunity to restore a shoreline continuum going from emergent wetland, through wetland shrub, wetland/upland transition, and finally to forest. Also affords a good opportunity to establish warm season grasses in upland areas in addition to a forested fringe. Due to its location in a city park, the site would benefit from interpretive signage. Major Benefits: Creation of important wetland habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; provides educational opportunities for the local community; provides additional water buffering capacity.

7) <u>I-64 Crossing of Eastern Branch/Lancelot Drive</u> - This site is located on the south shore of the Eastern Branch just upstream of the I-64 bridge in Virginia Beach. A former dredge spoil disposal site, a large portion of this low marsh system is dominated by *Phragmites* and it is considered to be a source of *Phragmites* to surrounding marshes. The project will consist of regrading to eliminate *Phragmites* with limited disturbance to the remaining portions of the site, planting of low marsh and high marsh vegetation, and possibly the creation of tidal guts. The replacement of *Phragmites* dominated areas with salt marsh vegetation such as *Spartina alterniflora* and *Spartina patens* will increase the healthy salt marsh wetland acreage on the site from 1.3 to 5.4 acres.

Recommendations: It may be advisable to limit the amount of high marsh created at this site to reduce the potential for the reestablishment of *Phragmites*. Plant upland species between the marsh and the nearby residential neighborhood to provide a buffer. Since there is only a narrow strip of suitable land available for this, it may need to be in the form of warm season grasses or shrubs rather than trees, in order to prevent shading of the wetland plantings. Major Benefits: restoration and enhancement of existing wetland

and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; removal of a source of the invasive *Phragmites australis* from the watershed.

8) Carolanne Farms Park - This site is located on the north shore of the Eastern Branch in Virginia Beach. The site currently consists of a mowed upland field with 0.22 acres of wetland and is located in a neighborhood park. It is adjacent to a large emergent wetland area bordering the Eastern Branch. The plan for this site is to excavate and regrade a portion of the uplands to create a 1-acre bowl-shaped wetland depression that drains into the nearby existing marsh. Totaling 1.22 acres, the created wetland will be planted with *Spartina alterniflora* to create a high quality low marsh, contain a small fringe area of *Spartina patens*, and will surround a small area of open water habitat. Approximately 250 square feet of emergent marsh will be converted to tidal gut to provide tidal exchange to the restored marsh. The project will be surrounded by an upland fringe.

Recommendations: As with Grandy Village and Woodstock Neighborhood Park, this may also be a good opportunity to restore a shoreline continuum going from emergent wetland, through wetland shrub, wetland/upland transition, and finally to forest. Also affords a good opportunity to establish warm season grasses in upland areas in addition to a forested fringe. Care should be taken not to shade out wetland plantings with trees. Due to its location in a city park, the site would benefit from interpretive signage. Major Benefits: Creation of important wetland habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; provides educational opportunities for the local community; provides additional water buffering capacity.

Sediment Remediation

Based on the results of a reconnaissance study, five sites in the Elizabeth River were selected for potential sediment remediation. Selection criteria included: public use, likelihood of contamination, likelihood of project success, and risk of recontamination. These five sites are described below:

1. Scuffletown Creek - This creek is a tributary to the Southern Branch of the Elizabeth River and is located approximately two nautical miles upstream from the confluence of the Eastern and Southern Branches in the City of Chesapeake. A city park with a boat ramp is located at the mouth of the creek. Scuffletown Creek is located directly across the Elizabeth River from two former creosote plants, Wycoff Pipe and Creosote and Atlantic Wood Industries, and the U.S. Naval Shipyard. The latter two facilities are National Priority List (Superfund) sites. There is potential for contamination from these facilities and from a small ship repair facility located on the southern side of the creek, as well as stormwater runoff from upstream areas.

2. East of Campostella Bridge - This site is situated in a small cove just east of the Campostella Bridge on the Eastern Branch approximately 1.75 nautical miles from the confluence of the Eastern and Southern Branches. The site is adjacent to the Campostella Heights neighborhood in the City of Norfolk and has significant public visibility. Likely

sources of contamination are ship repair facilities located directly across the river (Norfolk Shipbuilding and Drydock) and upriver, (Colonna Shipyard) and a construction fill site.

3. Scotts Creek - This creek is located in the City of Portsmouth and drains into the main stem of the Elizabeth River from the west bank. Neighboring communities are extremely active and have expressed an interest in restoring the creek. The most likely source of contamination is from three major stormwater outfalls that empty into the headwaters of the southern branch of Scotts Creek.

4. Paradise Creek - This creek is a tributary to the Southern Branch of the Elizabeth River approximately 2.5 nautical miles from the confluence of the Southern and Eastern Branches. It is located in the cities of Chesapeake and Portsmouth, adjacent to the Navy Shipyard property. It receives drainage from both the Navy Shipyard and Atlantic Wood Superfund sites, likely sources of contamination.

5. Eppinger and Russel - This site is located on the east side of the Southern Branch in the City of Chesapeake, approximately 3.2 nautical miles from the confluence of the Southern and Eastern Branches. The general area has a long history of creosote wood treatment starting around the turn of the century. Over the years, creosote was released directly into the water via waste water and spills, such that pockets of pure creosote can still be found in bottom sediments. Concentrations of polycyclic aromatic hydrocarbons near this site are likely the highest in the river.

For the initial feasibility study, one of the five sediment remediation sites, Scuffletown Creek, was selected for an intensive sediment contamination investigation and the other sites were more broadly characterized. Early in the feasibility investigation, it was determined that Paradise Creek may be included as part of the remedial investigations at the U.S. Navy Shipyard and Atlantic Wood Industries Superfund sites. Because of the possibility that this site could be included in Superfund clean-up activities, the Sediment Subcommittee recommended that this site be dropped from further investigation in the feasibility study.

The Scuffletown Creek remediation project is expected to consist of dredging and disposal of contaminated sediments from hotspot areas. Disposal options are currently under evaluation. The approach used to evaluate the sediment contamination in Scuffletown Creek included chemical and biological analyses. Chemical characterization included analysis of 148 samples from the creek. A subsample of these were evaluated for sediment toxicity. Subsequent biological analyses included additional sediment toxicity tests, evaluation of benthic macroinvertebrate community structure and an investigation of the incidence of tumors in resident fish populations. The chemical data was useful in identifying hotspots and deriving clean-up scenarios (see below). The biological analyses provided information on the impacts of sediment contamination on living resources in Scuffletown Creek and a baseline for evaluating the environmental benefits of sediment remediation.

The preliminary chemical characterization information for the remaining sites, Scotts Creek, Campostella Bridge, and Eppinger and Russel site, was used to prioritize sites for future, more intensive, characterization and sediment remediation studies.

Derivation of Clean-up Values

There are several benchmarks that have been used to evaluate sediment quality, these include: empirical approaches such as Long and Morgan's (1990) Effects Range-Low and Effects Range-Median (ERL/ERM) and the threshold effects level/probable effects level (TEL/PEL) developed by Smith et al. (1996) that rely on correlations between sediment concentrations and biological effects; EPA's sediment quality guidelines that use a theoretical approach to estimate bioavailability of sediment contaminants; and more recently the development of consensus-based guidelines that integrate the empirical and theoretical approaches. At present, the number of chemicals for which EPA or consensus-based guidelines exist, is limited. Therefore, sediment contaminant data in Scuffletown Creek were evaluated by comparing ambient concentrations to either PEL or ERM values (whichever was lower). These benchmarks represent concentrations above which biological effects are frequently observed.

In order to summarize and integrate this information, Sediment Quotient Values (SQV) were calculated by dividing the concentration of a contaminant at each site by its sediment quality benchmark (i.e., ERM or PEL), summing these values and then taking the average. The SQV reflects both the magnitude and frequency by which benchmarks are exceeded and provide a way to integrate the chemical data on one scale. In addition, several researchers have shown a good correlation between SQVs and sediment toxicity or benthic community impairment (McGee *et al.*, 1999, Canfield *et al.* 1996, Fairey *et al.* 1999). Data from Baltimore Harbor presented in McGee *et al.* (1999) indicated that ERM SQVs of 0.4 and 0.8 delineated ranges where, at the low end, there was no observed sediment toxicity and, at the high end and above, there was always acute toxicity. Fairey *et al.* (1999) reported a similar relationship between SQVs and benthic community health in marine and estuarine sediments from California. Since these numbers seemed robust, the Sediment Subcommittee decided that 0.4, 0.6 and 0.8 would be the SQVs that would be contoured to identify hotspots in Scuffletown Creek, with the contours representing different clean-up scenarios.

Analysis of Environmental Benefits

Five indicators of sediment quality in Scuffletown Creek were used to evaluate the environmental benefits of sediment remediation. These included: the Benthic Index of Biotic Integrity (B-IBI) which is a multi-metric index indicative of benthic macroinvertebrate health; toxicity of surficial sediments which typically reflects newly deposited sediments and the suitability of sediments for benthic organisms; toxicity of subsurface sediments which often reflects historic contamination and is habitat for deep dwelling, long-lived benthic organisms; prevalence of tumors in resident fish populations that is an indicator of fish community health and concentrations of sediment contaminants.

The Sediment Subcommittee developed a functional numerical index in which the value recorded for each of these indicators was placed on a scale from 1 (poor) to 7 (excellent). For example, in characterizing the toxicity of surficial sediments, high toxicity (less than 50% survival) was given a score of 1; moderate toxicity (50-80% survival) a score of 3; low toxicity (over 80% survival) a score of 5 and no toxicity (approximately 100% survival) a score of 7. The highest possible score is 35 and the lowest 5. The Sediment Subcommittee used this scoring system to estimate current conditions at Scuffletown Creek and the expected future conditions under the various clean-up scenarios (Tables 5 through 8). Projected scores ranged from 14, for current conditions in Scuffletown Creek /future conditions without the project, to 24.5 for clean-up levels using the 0.4 SQV.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The James River estuary is Virginia's most highly industrialized river system. It is also important as the Chesapeake Bay's largest port, a major oyster production area, and for its commercial and recreational fisheries. Despite the highly industrialized nature of the Hampton Roads area, the lower James River estuary continues to provide valuable habitat for fish and wildlife resources.

Along with the Chickahominy, Nansemond, and Lafayette Rivers, the Elizabeth River is a major tributary of the James River estuary. The Elizabeth River basin has been extensively altered by development, including the construction of the 2500-acre Craney Island Disposal Area in the mid-1950s which effectively "extended" the length of the main stem of the river by two miles.

The mean tide range in the Elizabeth River is 2.5 feet, with a maximum of 3.1 feet at the Southern Branch headwaters in the city of Chesapeake. Hampton Roads is within the meso- to polyhaline section of the Chesapeake Bay, with salinities averaging between 15 and 28 parts per thousand, depending on the depth and amount of freshwater inflow (Richards and Morton 1983).

Historic Changes in Aquatic Habitats of Lower James River Estuary

The Elizabeth River basin has undergone significant shoreline and channel modifications for over 200 years as port facilities and surrounding cities have developed. Some filling of low areas in Hampton Roads began after arrival of colonists in the 1600s to 1700s, but large scale filling of wetlands, creeks, and shoreline areas started in the late 1800s, with many creek systems totally filled in for storm sewer systems or upland creation. There has been extensive filling along the Eastern and Southern Branches of the Elizabeth River for port and commercial facilities. The existing Craney Island Disposal Area filled in approximately 2500 acres of Hampton Roads.

Comparison of Coast Guard Charts from 1909-1913 and 1983 indicates a net loss of at least 4600 acres, or 13 percent, of aquatic habitat in the lower James River/Hampton Roads/Elizabeth River. Nichols and Howard-Strobel (1986) indicate that the Elizabeth

River system itself has had a 27 percent reduction in open water, wetlands and intertidal areas since the late 1800s. Priest and Hopkins (1997) estimate that as much as 50% of the tidal wetlands in the Elizabeth River Basin were lost between 1944 and 1977.

Significant deepening of the channels of the port started in the late 1800s. The Norfolk Harbor Reach and Elizabeth River channels have been deepened from an average natural depth of 20 feet to between 35 and 45 feet. These channels now comprise approximately 25 percent of the original river area and have resulted in a 50 percent increase in river volume. There may be a direct correlation between increasing channel depths and the frequency of maintenance dredging, as evidenced by sedimentation rates in the Elizabeth River that have increased by 1000 to 10,000 percent over natural rates (Nichols and Howard-Strobel 1986).

Other hydrodynamic changes are evident as well. Twenty-four percent of the tidal prism of the Elizabeth River has been lost as a result of filling, and tidal currents at the mouth of the river have been reduced by 17 percent (Nichols and Howard-Strobel 1986). These changes have likely contributed to low flushing rates in the Elizabeth and probable increases in salinity values.

Most filled or dredged areas within the port were once wetlands and shallow water habitats important as foraging and nursery areas for finfish, benthos, waterfowl and shorebirds. Dredging of deep channels and borrow areas and increased sedimentation by fine grained and contaminated sediments has created bottom areas with lower water quality and a less diverse assemblage of benthic species.

Finfish

A number of general studies of finfish in the lower James River estuary have been conducted, primarily in association with environmental assessments of Federal and private projects. A wide variety of resident and migratory finfish utilize or migrate through the Hampton Roads area.

Anadromous fish, species that live in saline water and spawn in freshwater rivers, pass through the Hampton Roads area to reach their spawning and nursery grounds in the upper James River estuary between the Chickahominy River and Richmond and beyond. These species include striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), hickory shad (*A. mediocris*), blueback herring (*A. aestivalis*), alewife (*A. pseudoharengus*), gizzard shad (*Dorosoma cepedianum*), Atlantic herring (*Clupea harengus*) and white perch (*Morone americans*). No major, successful spawning of striped bass, American shad, or river herrings is known to occur in the Elizabeth River. However, it is believed that upriver migration associated with high freshwater flow during storm events does occur in spring.

Many species of finfish that spawn in the ocean or lower Chesapeake Bay utilize the lower James River estuary as a nursery area or as adults. Dominant species include:

spot (*Leiostomas xanthurus*)
Atlantic croaker (*Micropogon undulatus*)
menhaden (*Brevoortia tyrannus*)
weakfish (*Cynoscion nebulosus*)
summer flounder (*Paralichthys dentatue*)
bluefish (*Pomatomus saltatrix*)
American eel (*Anguilla rostrata*)
striped mullet (*Mugil cephalus*)
silver perch (*Bairdiella chrysura*)
black drum (*Pogonias cromis*)

southern lungfish (*Menticirrhus americanus*)

A number of resident estuarine finfish are found in the lower James River estuary. Dominant species include:

hogchoker (*Trinectes maculatus*)
bay anchovy (*Anchoa mitchilli*)
Atlantic silverside (*Menidia menidia*)
gobies (*Gobiosoma sp.*)
striped killifish (*Fundulus majalis*)
blennies (*Chasmodes bosquianus* and *Hypsoblennius hentzi*)
oyster toadfish (*Opsanus tau*)

A demersal (bottom) finfish survey of the lower James River estuary, including Hampton Roads and the Elizabeth River concluded that the principal uses of the area by finfish are 1) as nursery grounds for spot, American shad, striped bass and weakfish; 2) feeding grounds for adult spot, Atlantic croaker, weakfish, and summer flounder; and 3) spawning grounds for resident forage species such as bay anchovy and Atlantic silverside (Hedgepeth *et al* 1981).

Avifauna

Mid-Winter Waterfowl Survey data collected 1998-2000 in the lower James River estuary, including the Elizabeth River, included these waterfowl species, in order of relative abundance:

canvasback	(*Aythya valisineria*)
ruddy duck	(*Oxyura jamaicensis*)
Canada goose	(*Branta canadensis*)
bufflehead	(*Bucephala albeola*)
northern shoveler	(*Anas clypeata*)
mallard	(*Anas platyrhyncos*)

ring-neck duck	(*Aythya collaris*)
mergansers	(*Mergus spp.*), (*Lophodytes cucullatus*)
gadwall	(*Anas strepera*)
American widgeon	(*Anas americana*)
green-winged teal	(*Anas crecca*)
scoters	(*Melanitta spp.*)
American black duck	(*Anas rubripes*)
common goldeneye	(*Bucephala clangula*)
northern pintail	(*Anas acuta*)
redhead	(*Aythya americana*)
oldsquaw	(*Clangula hyemalis*)
mute swan	(*Cygnus olor*)

Other waterfowl species that can be expected to commonly winter on the waterway include lesser scaup (*Aythya marila*), greater scaup (*Aythya affinis*), and wood duck (*Aix sponsa*). Species occurring infrequently or in small numbers include tundra swan (*Cygnus columbianus*), snow goose (*Chen caerulescens*), and Atlantic brant (*Branta bernicla*). Species that typically breed within the project area include Canada geese, wood ducks, black ducks, and mallards.

Other birds expected to occur in association with Elizabeth River aquatic habitats include: great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), double-crested cormorants (*Phalacrocorax auritus*), American avocet (*Recurvirostra americana*), black-bellied plover (*Pluvialis squatarola*), lesser yellowlegs (*Tringa flavipes*), dunlin (*Calidris alpina*), semi-palmated sandpiper (*Calidris pusilla*), dowitcher (*Limnodromus spp.*), willet (*Catoptrophorus semipalmatus*), black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), ring-billed gull (*Larus delawarensis*), laughing gull (*Larus atricilla*), least tern (*Sterna antillarum*), royal tern (*Sterna maxima*), and caspian tern (*Sterna caspia*). Many of these species and other waterbirds are observed as transients, sometimes in high concentration, at and around Craney Island at the mouth of the Elizabeth. Raptors such as the Federally threatened bald eagle (*Haliaeetus leucocephalus*) and the osprey (*Pandion haliaetus*) nest and forage in the watershed. Many species use this area as a feeding and/or resting stop during migration.

Benthic Resources

Benthic invertebrates are the predominant food source for many estuarine fishes, including the young of many sport and commercial species, and many motile invertebrates, such as the blue crab. Studies have suggested that while the densities of the benthos of shallow sandy areas in the Chesapeake Bay are lower than that of deeper and offshore areas, the populations turn over rapidly and are exploited by predators (Virnstein, 1976).

In one study of the macrobenthos of Hampton Roads, the lower James River and the Elizabeth River, 175 taxa were collected. The dominant taxa were Polychaeta (54 forms), Gastropoda (23 forms), Amphipoda (22 forms) and Bivalvia (18 forms), with a higher species richness on sand substrates versus mud bottoms (Boesch 1971, 1972, 1973).

A year-long study of macroinvertebrates at 12 stations located along the major navigation channels in the lower Chesapeake Bay, Hampton Roads, Elizabeth River and James River identified a total of 227 taxa (Dauer 1984). Polychaetes comprised 45% of the taxa, bivalves 12%, amphipods 12%, and gastropods 11%. Species found to be dominant in the high silt-clay sediments of inner Hampton Roads, Elizabeth River, and James River included: *Leucon americanus*, *Streblospio benedicti*, *Nereis succina*, *Eteone heteropoda*, and *Leitoscoloplos fragilis*.

Wetlands

Though the project area is situated within a highly developed landscape, wetland systems do persist, particularly near the Elizabeth's headwaters and in portions of the watershed with relatively lower-density development. Wetland types found in the project area include palustrine forested, palustrine emergent, estuarine, lacustrine, and riverine. Extensive saltmarsh communities dominated by saltmarsh cordgrass (*Spartina alterniflora*) are present in the Elizabeth River basin. Wherever wetland systems exist in the project area, they are likely to be adjacent to lands characterized by human development.

Commercial Resources

Commercial fisheries on the lower James River estuary and Elizabeth River include oysters (*Crassostrea virginica*), blue crab (*Callinectes sapidus*), hard clam (*Mercenaria*), Atlantic croaker, American eel, striped bass, bluefish, and sea trout. In 1994 and 1995, the Virginia Marine Resources Commission reported that the main commercial fisheries on the Elizabeth River itself were blue crab, Atlantic croaker, and American eel.

Despite severely depleted bay-wide oyster abundance, the lower James River remains an important oyster harvest region. In 1992-93, the majority of Virginia's harvest came from these waters. In Hampton Roads, oyster abundance is limited by the predatory oyster drill (*Urosalpinx cinerea*), and the pathogens MSX (*Haplosporidium nelsoni*) and dermo (*Perkinsis marinus*).

Hard clams are also present in Hampton Roads, near the Elizabeth River mouth. Hard clams in this area are currently condemned for harvest and consumption due to fecal coliform contamination.

Threatened and Endangered Species

There are several active Federally threatened bald eagle (*Haliaeetus leucocephalus*) nests in the Elizabeth River watershed, however, no Federally threatened or endangered species are known to occur within the project impact zones.

Future Without the Project

The future condition without the wetland restoration project is the continuation of present degraded conditions. This will result in continued scarcity of healthy wetland habitat, reduced water quality, and low abundance and diversity of fish and wildlife species that depend on wetlands for their life requirements. Several of the sites, if not restored, will continue to serve as source areas for the spread of the invasive *Phragmites australis*, further degrading wetland habitats in the watershed.

The expected future condition without the sediment remediation project in Scuffletown Creek is a continuation of present high levels of contaminants in sediments and poor water quality. Perpetuation of these conditions will result in continued low abundance and diversity of fish and benthic resources, in addition to potential impacts to other wildlife preying upon on these species.

BIOLOGICAL EFFECTS OF THE PROJECT

Most of the biological effects of this project are positive. Impacts to water quality and upland, wetland, and shallow water fish and wildlife habitats are short-term and very limited compared to the long-term benefits derived from the habitat restoration and sediment remediation measures expected to be employed in this project. The results of the HEP analysis and the wetland functional assessment suggest that the proposed restoration projects will make a substantive environmental improvement.

Temporary local effects to water quality are expected during all restoration and remediation activities. Sediments will be released to the water column during the dredging of contaminated bottom sediments at Scuffletown Creek, excavation activities at previously filled wetlands, and the placement of fill materials in shallow water areas to create the elevations necessary for intertidal wetland development. Efforts will be made to minimize the resuspension and transport of sediments during construction activities. The long-term benefits of the project to water quality in the Elizabeth River basin are expected to greatly exceed the temporary impacts. The wetland restoration projects will result in improved water quality by increasing the wetland acreage available to filter sediments and contaminants from stormwater runoff and non-point source discharges. The sediment remediation project at Scuffletown Creek will eliminate a source of contaminants this is currently contributing to the decline of water quality in the watershed and potentially causing acute and chronic toxicity to ecological receptors.

In many of the wetland restoration projects, habitat that is currently in the form of upland, degraded high marsh dominated by *Phragmites*, and shallow water habitat will be converted to low saltmarsh containing *Spartina* sp. Most of the upland sites and degraded high marsh sites, with the possible exception of Woodstock Neighborhood Park, are fill areas that historically supported emergent saltmarsh. The shallow water habitat that currently dominates the ODU drainage canal site receives large inputs of sediment laden stormwater runoff and is expected to be degraded due to the presence of runoff-derived contaminants. Creation of an emergent wetland at the mouth of the canal will provide water quality and habitat benefits that do not currently exist. Shallow water habitat that will be converted to wetland through filling at the Jordan Bridge is most likely contaminated with industrial contaminants from nearby wood treating facilities. The creation of wetlands at the Jordan Bridge will provide a net benefit to the local aquatic community by covering contaminated sediments and increasing the runoff filtering capacity of the embayment. Approximately 250 square feet of emergent marsh at Carolanne Farms will be excavated to establish a tidal connection between the restored marsh and nearby marshes. However, the project will result in a net increase of 1 acre of tidal emergent wetland.

CONCLUSIONS

The Elizabeth River Environmental Restoration Project will improve fish and wildlife habitat value within the Elizabeth River watershed by: 1) creating, improving, and enhancing wetland and upland areas that are breeding, nursery, and foraging habitats for fish and wildlife; and 2) reducing the threat to biological resources at certain locations where sediment contamination exists. The Service therefore concurs with Norfolk District's recommended plan of implementing sediment clean-up in Scuffletown Creek and wetland restoration at eight sites described earlier in this report. Because the environmental impacts of the project are overwhelmingly beneficial and more than offset the minor and temporary impacts from construction activities, the Service also concurs with Norfolk District's Finding of No Significant Impact.

We encourage the Corps to continue to work with the Service, other Federal, State, and local government agencies, and non-governmental organizations in the future to improve habitat and water quality conditions in the Elizabeth River watershed. Site-specific recommendations were presented previously in this document. We recommend that the following additional issues be evaluated during future phases of the project: 1) develop a monitoring plan and protocol for adaptive management; 2) develop a *Phragmites* monitoring and control plan for the wetland restoration sites; 3) do not use excavated sediments from sites that are dominated by *Phragmites* as fill material at sites that require filling because they will most likely contain *Phragmites* rhizomes; and 4) consult with the Service concerning the planting of warm season grasses and trees in upland fringe areas adjacent to the wetland projects.

We again appreciate the opportunity to consult with the Corps and reiterate the Service's support for this important restoration initiative. If you have any questions concerning these comments, please contact Jason Miller at (410) 573-4522.

Sincerely,

John P. Wolflin
Supervisor
Chesapeake Bay Field Office

REFERENCES

Boesch, D.F. 1971. Distribution and Structure of Benthic Communities in the Hampton Roads Area, Virginia. Special Report in Applied Marine Science and Ocean Engineering No. 15, Virginia Institute of Marine Science. Gloucester Point, VA.

Boesch, D.F. 1972. Species diversity of marine macrobenthos in the Virginia area. Ches. Sci. 13:206-211.

Boesch, D.F. 1973. Classification and community structure of macrobenthos in the Hampton Roads area, Virginia. Marine Biology 21:226-244.

Canfield, T.J., F.J. Dwyer, J.F. Fairchild, P.S. Haverland, C.G. Ingersoll, N.I. Kemble, D.R. Mount, R.W. LaPoint, G.A. Burton, and M.C. Swift. 1996. Assessing contamination in Great Lakes sediments using benthic invertebrate communities and the Sediment Quality Triad. J. Great Lakes Res. 22:565-583.

Dauer, D.M. 1984. Macrobenthic Communities of the Lower Chesapeake Bay. Old Dominion University, Applied Marine Research Laboratory. Norfolk, VA.

Fairey, R., J. Oakden, S. Lamerdin, B. Anderson, J. Hunt, and E. Long. 1999. Assessing Ecological Impacts on Benthic Community Structure from Sediments Contaminated with Multiple Pollutants. Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, November 1999, Philadelphia, PA.

Hedgepeth, M.Y., J.V. Merriner and F. Wojcik. 1981. Nekton Utilization of Aquatic Resources in the Elizabeth River and the Lower James River. In: A Study of Dredging Effects in Hampton Roads, Virginia. W.I. Priest (ed.). Special Report in Applied Marine Science and Ocean Engineering No. 247. Virginia Institute of Marine Science. Gloucester Point, VA.

Lewis, J.C. and R.L. Garrison. 1983. Habitat suitability index models: clapper rail. U.S. Fish and Wildlife Service, FWS/OBS-82/10.51. 15 pp.

Long, E.R. and L.G. Morgan. 1991. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program.

NOAA Technical Memorandum NOS OMA 52. Office of Oceanography and Marine Assessment, Seattle, WA.

McGee, B.L., D.J. Fisher, L.T. Yonkos, G.P. Ziegler and S. Turley. 1999. Assessment of sediment contamination, acute toxicity and population viability of the estuarine amphipod *Leptocheirus plumulosus* in Baltimore Harbor. Environmental Toxicology and Chemistry. 18:2151-2160.

Nichols, M.N. and M.M. Howard-Strobel. 1986. Man's Physical Effects on the Elizabeth River.In: C.Y. Kuo and T.M. Younos (eds.). Effects of Upland and Shoreline Land Use on the Chesapeake Bay Research Conference, March 20-21, 1986.

Priest, W. I., III, and K.J. Hopkins. 1997. Historic losses of wetland habitat in the Elizabeth River. Virginia Institute of Marine Science for the Virginia Department of Environmental Quality, Virginia Coastal Resource Management Program and NOAA.

Richards, D.R. and M.R. Morton. 1983. Norfolk Harbor and Channels Deepening Study; Report 1, Physical Model Results; Chesapeake Bay Hydraulic Model Investigation. Tech. Rpt. HL-83-13. U.S. Army Corps of Engineers, Waterways Experiment Station. Vicksburg, MS.

Virnstein, R.W. 1976. The Effects of Predation by Epibenthic Crabs and Fishes on Benthic Infauna in Chesapeake Bay. Dissertation of the College of William and Mary. Williamsburg, VA.

U.S. Fish and Wildlife Service. 1980. Habitat Evaluation Procedures (HEP). Ecological Services Manual 102. Division of Ecological Services. Washington, D.C.

United States Department of the Interior

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177 Admiral Cochrane Drive
Annapolis, MD 21401

November 30, 2000

Colonel Allan B. Carroll
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Craig Seltzer

Re: Elizabeth River Environmental Restoration

Dear Colonel Carroll:

Enclosed please find a Draft Fish and Wildlife Coordination Act Report for the Elizabeth River Environmental Restoration. We believe that this project will improve fish and wildlife habitat within the Elizabeth River watershed. We appreciate the opportunity to consult with the Corps concerning this important restoration initiative. If you have any questions, please contact Dan Murphy of my office at (410) 573-4521.

Sincerely,

for John P. Wolflin
Supervisor

November 30, 2000

Colonel Allan B. Carroll
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Craig Seltzer

Re: Elizabeth River Environmental Restoration

Dear Colonel Carroll:

This constitutes the **Draft Report** of the U.S. Fish and Wildlife Service (Service) on the proposed environmental restoration project for the Elizabeth River in the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia. It is submitted in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 884, as amended; 16 U.S.C. 661 *et seq.*) and Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). The purpose of this report is to present an evaluation of the project alternatives and to set forth the Service's official position on the project as described in the Formulation Analysis Notebook dated September 2000, the Project Study Plan dated July 1998, and other project-related documents.

INTRODUCTION

The Elizabeth River watershed encompasses approximately 300 square miles within the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia. A tidal tributary to the Chesapeake Bay, the Elizabeth River has become heavily impacted by industrial and urban development over the years resulting in many environmental problems. Three hundred years of industrial pollution have made the Elizabeth River one of the most polluted rivers in the United States. Over the years, stormwater runoff, point source discharges, and spills from commercial, industrial, and military sources have contaminated river sediments and lowered water quality. Industrial and urban development and related filling activities have destroyed many wetland habitats on the river. Only a fraction of the original wetlands remain to support wildlife and filter storm water runoff, the greatest source of pollution to the river. It has been estimated that as much as 50 percent of the tidal wetlands in the Elizabeth River basin were lost between 1944 and 1977 (Priest and Hopkins 1997). In 1993, the Chesapeake Bay Program identified the Elizabeth River as one of the three Regions of Concern where contaminants pose the greatest threat to natural resources.

The Commonwealth of Virginia and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, and the non-profit Elizabeth River Project have partnered with the Corps to restore the Elizabeth River to the highest level practical. The specific area addressed by the project includes the Elizabeth River and its major tributaries including the Lafayette River, Eastern Branch, Southern Branch, and Western Branch. Contaminated sediment remediation and wetland restoration have been identified as the two major goals of the restoration project.

PROJECT DESCRIPTION

The Corps is currently in the final stages of a feasibility study that has evaluated 19 wetland restoration sites and 5 sediment remediation sites within the Elizabeth River watershed for possible inclusion in the project.

Wetland Restoration

In the initial stages of the feasibility investigation, eight of the original 19 sites were eliminated from further consideration. Sites were eliminated for the following reasons: private property issues; space constraints resulting from the presence of buildings, roads, or utilities; potentially contaminated landfills on-site; former industrial sites with contaminated soils; the presence of desirable mature wooded habitat on-site; and stormwater management issues. The remaining 11 sites were subjected to cost effectiveness analysis, incremental cost analysis, and environmental benefits analysis using two assessment methodologies: a Habitat Evaluation Procedure (HEP) and a wetlands functional assessment. The size of wetland habitats currently existing on the sites ranges from 0.03 to 2.9 acres. Wetland acreages on the restored sites are expected to range from 0.33 to 7.0 acres. Total wetland acreage will be increased from 4.9 to 18.2 acres.

The HEP method originally developed by the U.S. Fish and Wildlife Service (USFWS 1980), assesses the suitability of habitat conditions for selected species in a study area relative to ideal conditions for the same species. The HEP procedure accounts for both the quality and quantity of habitat by multiplying the areal extent of habitat under consideration by a species-specific numerical habitat suitability index (HSI). The HSI value varies from 0 to 1 (0 represents no value and 1 represents optimal habitat) and is multiplied by acreage to yield habitat units (HU) for each evaluation species. Habitat units are a quantitative expression of environmental output, with one HU being equivalent to one acre of optimum habitat for the species in question.

Due to the complexity and effort involved in using the original USFWS HEP procedures, the application is often streamlined and tailored to meet individual project evaluation objectives. Specific measures which were exercised in the present study include: 1) use of "typical" conditions at each site in lieu of strict delineation of habitat cover types; 2) deliberate selection of species that would benefit from saltmarsh restoration; 3) use of only one evaluation species; and 4) relaxation of the minimum habitat size criterion for the species.

The HEP for the Elizabeth River Project was performed by personnel from the Corps, the Service, and the Virginia Institute of Marine Science. For the baseline habitat evaluation, site visits were conducted in October 1998 and November 1999. Topographic surveys, aerial photos, and wetland delineation maps were also used to evaluate the baseline and post- restoration field parameters associated with the HEP model. Initially, several avian, mammalian, and fish evaluation species were selected based on restoration concepts and availability of species models. However, it soon became apparent that few of the models accurately reflected conditions at the restoration sites. For example, the muskrat model, developed for fluvial conditions, undervalued the tidal marsh habitats being evaluated for the project. The marsh wren (*Cistohorus albus*), yellow crown night heron (*Nyctanassa violacea*), great egret (*Casmerodius albus*), juvenile spot (*Leiostomus xanthurus*) and croaker (*Micropogon undulatus*) were also considered but the models were not appropriate for the river and shoreline conditions in the urban and industrial sites proposed for restoration. As a result, the HEP analysis was limited to one avian species, the clapper rail (*Rallus longirostris*). The clapper rail has multiple life requisite factors (food, cover, breeding, and water) within the proposed emergent marsh restoration sites. The HEP models consider individual life requisite factors based on several conditions that must be considered together in order to evaluate the individual life requisite. For example, the "food/cover" life requisite for the clapper rail is based on three habitat variables: percentage of wetland shoreline that borders flat to gently sloping banks or tidal flats exposed at low tide; percentage of total area that is salt or brackish emergent or scrub/shrub wetlands; and percentage of area of emergent or scrub/shrub wetlands within 15 meters of tidally influenced water bodies.

Using the Clapper Rail model (Lewis and Garrison 1983), an HSI was calculated for baseline and restored conditions at each proposed restoration site. The HSI was then multiplied by site acreage to yield the number of habitat units supplied by each scenario (Table 1). Habitat units for baseline conditions at the sites ranged from 0 to 1.83 while the range of habitat units for the restored sites increased to 0.33 to 5.9. For each site, the number of habitat units expected to occur in the future without restoration was subtracted from the number of habitat units to occur in the future with restoration to obtain the benefits due to site restoration. Benefits with restoration ranged from 0.26 to 4.1 habitat units.

The second methodology employed to assess the environmental benefits of each of the alternative restoration sites was a wetlands functional assessment score. The concept behind the functional assessment is to capture the range of beneficial functions provided by wetlands systems, such as the capacity of wetlands to produce plant material to support aquatic food chains, to provide fish and wildlife habitat, to improve water quality, to reduce shoreline erosion, and help reduce shoreline flooding, and to improve community aesthetics and provide educational opportunities. A panel of subject matter experts (composed of biologists from the Corps, the Service, and the Virginia Institute of Marine Science) developed a functional numerical index in which the values recorded for each of seven wetlands functions were assigned a score of between 1 (low) to 5 (high) to describe how well each wetland site performs a specific function. The wetland functions considered include: 1) primary production, measured by organic production, decomposition, and availability of plant material as food to aquatic organisms; 2) fish and wildlife habitat, as measured by tidal regime, ratio of cover to open water, ratio of shoreline to wetland area, and cover type diversity; 3) water quality, characterized by watershed area, detention time, width of wetlands, percent cover, and stormwater features; 4) erosion buffer, as measured by vegetative cover type, width of marsh, slope of marsh, and elevation of marsh; 5) flood buffer, measured by storm tide volume and floodplain width; 6) aesthetics, characterized by "greenspace" availability, existing degradation, and site visibility; and 7) public accessibility and educational value, characterized by accessibility of site, proximity to schools and neighborhoods, and recreational opportunities.

The expert panel judged the existing condition, the expected future without -project condition, and the expected future with project conditions for the 11 alternative restoration sites, on the 1 to 5 scale for each of the seven measurements of wetlands functions. The seven separate functional index scores were weighted equally and then summed to provide a more complete representation of how well each wetland site contributed across wetland functions. The highest possible score (a score of 5 for all seven functions) was calculated to be a score of 35. Functional scores at each site were then multiplied by acreage at that site to reflect the fact that the functional benefits provided would be proportional to the size of the wetlands. This proportionality technique is analogous to the habitat unit concept, in which both quality and quantity are important factors in the determination of environmental outputs. Projected scores at each site ranged from 0 to 60.9 for the without-project future condition and increased to 8.58 to 231.0 for the with-project future condition (Table 2). Expected functional scores under each alternative restoration site were compared to the expected future without-project score (and the difference calculated) to yield an overall numerical value of wetlands improvement or benefit. The value of overall wetland improvements ranged from 7.06 to 170.1.

The habitat unit benefits and the numerical functional scores were converted to average annual equivalents by linear interpolation to account for the fact that full ecosystem benefits are not expected to occur until year three post-restoration (Table 3). These values were then factored into the cost effectiveness and incremental cost analyses. The cost analyses resulted in the elimination of three more sites because they fell at a break point on the incremental cost curve where a large jump in cost was required to achieve a relatively small benefit in the form of restored habitat. As a result, eight of the original 19 candidate wetland restoration projects totaling 18.2 acres of restored emergent wetland remain under consideration (Table 4; Figure 1).

The projects will consist of the creation or enhancement of tidal emergent salt marsh habitats through grading, filling, and planting. In general, the restored marshes will contain a natural progression (from low marsh to high marsh) of saltmarsh cordgrass (*Spartina alterniflora*), salt meadow hay (*Spartina patens*), marsh elder (*Iva frutescens*), groundsel tree (*Baccharis halimifolia*), and wax myrtle (*Myrica cerifera*).

Many of the sites contain upland fringe areas that afford the opportunity to plant warm season grasses such as deer tongue (*Dichanthelium clandestinum*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon virgatum*), and switch grass (*Panicum virgatum*). These grasses provide important food and cover habitat for wildlife. Periodic mowing (once during second growing season, once every three years thereafter) of warm season grass plantings is necessary to reduce annual weed invasion and allow light to penetrate to the warm season grass seedlings. Upon request, the Service will supply the Corps with a planting scheme for warm season grasses. At sites containing more expansive upland areas, trees with high wildlife value such as white oak (*Quercus alba*), black oak (*Quercus velutina*), willow oak (*Quercus phellos*), black cherry (*Prunus serotina*), and hackberry (*Celtis occidentalis*) can be planted. Trees should not be planted so close to the restored wetlands as to excessively shade the wetland plantings.

The descriptions of the individual projects, benefits, and site-specific U.S. Fish and Wildlife Service recommendations are described in detail below.

1) Scuffletown Creek - The site is located in Chesapeake on the north shore of Scuffletown Creek near its confluence with the Elizabeth River. The Scuffletown Creek project will convert a currently degraded fringe area dominated by rubble fill and containing only 0.08 acres of wetland dominated by *Baccaris hamifolia* and *Iva frutescens* into a 0.33 acre emergent fringe wetland that will connect two healthy wetland areas. The restoration of the site will consist of excavation of rubble and debris and replacement with soils that are suitable to support wetland vegetation. The site will be graded to the appropriate elevation and planted with the emergent vegetation described above.

Recommendations: The site is currently fringed by a thin forested area. This should be left in place to maintain habitat diversity at the site and to provide a buffer between the restored wetland and nearby degraded uplands. Major Benefits: reestablishes wetland habitat connectivity between two existing marshes; provides additional wildlife habitat and water buffering capacity.

2) Grandy Village - The Grandy Village site is named for a nearby public housing complex and is located in Norfolk on the north shore of the Eastern Branch of the Elizabeth River. The site is currently dominated by a largely undeveloped upland fill area and supports approximately 2.9 acres of fringe saltmarsh along the river. Tidal guts occur at the eastern and western edges of the site. *Phragmites australis* is prevalent throughout the site. Historic information suggests that the site contained a series of small tidal creeks surrounded by salt marshes.

The restoration objective is to establish a wider saltmarsh fringe community and eradicate *Phragmites*. The restoration of this site will result in the return of the shoreline to the more irregular configuration that existed prior to filling. This will require excavation and removal of large quantities of material and regrading to create low marsh areas while increasing the available shoreline for new plantings. Wetland restoration will be designed around existing stands of vegetation and tree growth on the site and result in 7 acres of restored wetland habitat. The restored site will also contain walkways and bridges to allow for public access. The site plan calls for a variety of planting areas containing low marsh, high marsh fringe, upland fringes planted with shrubs, and the addition of trees to complement the pines, cedars, and willow currently existing on site.

Recommendations: The restoration of this site provides a significant opportunity to establish warm season grasslands in upland areas. A riparian forest should be created landward of the restored wetlands to provide a buffer from existing development. A grassland or shrub habitat (*Baccharis halmifolia*, *Iva frutescens*, and *Myrica* sp.) transition zone could be created between the forest and the wetland to increase habitat diversity and reduce the possibility of shading impacts. Soil amendments may be necessary to permit the establishment of vegetation in areas that are currently barren. It may be possible to use soils excavated from the site at other sites that require fill. The restored site would benefit from educational signage. Major Benefits: Creation of important wetland and shallow water habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish (including anadromous fish and other forage species) and wildlife (including waterfowl, wading birds such as the blue heron, song birds, and neotropical migrants); provides educational opportunities for the local community; provides additional water buffering capacity.

3) Old Dominion University (ODU) Drainage Canal - This site is located in Norfolk, on the west side of ODU, adjacent to the sailing center, at the mouth of the drainage canal on the mainstem of the Elizabeth River. The tidally influenced canal is approximately 1000 feet long and drains surface runoff from much of the campus. One side of the canal borders a landfill on Norfolk City property. The site currently consists of intertidal mudflat and supports approximately 0.03 acres of wetland habitat. The shoreline adjacent to the site consists mostly of rubble fill. The restoration design for this project consists of the creation of 0.6 acres of low marsh on the intertidal mudflat where the canal discharges into the river. The project will include the construction of a rock weir for water flow dissipation of discharge from the canal, sand fill to obtain the proper elevation for the plantings, and a low-crested rock sill for river generated wave dissipation.

Recommendations: Explore the opportunity of creating riparian habitat along the shoreline of the landfill by sloping fill material up against the existing embankment and planting trees. Good opportunity to use excavated material generated at other sites. This project provides an excellent opportunity for a student at ODU to perform a before and after study to document water quality benefits. Major Benefits: will benefit water quality by sequestering sediments and contaminants in runoff from a large surface area that is currently flowing unchecked into the Elizabeth River; creates additional fish and wildlife breeding, nursery, and foraging habitat; will aid in the control of shoreline erosion.

4) Portsmouth City Park - This site is located in Portsmouth on Bailey's Creek on the Western Branch of the Elizabeth River. A swale marks the location of one of the two wetland restoration projects on the site. The other project is located nearby in an erosional area on the banks of Bailey's Creek. Historic aerial photography shows that the

swale was once a tidal creek and a fringe marsh once existed in the erosional area. Both areas currently contain fill material consisting of asphalt, concrete, brick, and rock and support approximately 0.16 acres of total wetland habitat.

The restoration design for the swale project consists of an excavated inlet, resulting in a shallow wetland pocket, surrounded by a much expanded wetland planting area. A large *Spartina alterniflora* fringe will be created by expanding the +0.5 to 2.4 foot elevations and fringing this with *Spartina patens* at slightly higher elevations and finally, an upland bench that will provide a protective buffer of shrubs. The construction will include a sediment trap to capture sediment laden runoff from nearby parking lots and filter runoff into the wetland. Existing mature trees including pines, hackberry, and cypress will be protected and augmented with additional species. A trail and foot bridge will traverse the wetland. A fringe marsh will be reestablished in the erosional area on Bailey's Creek, restoring the original connectivity of marsh habitat along the banks of the creek. Restored wetland habitats at the site will total 0.85 acres.

Recommendations: Expand upland buffer plantings to include warm season grasses. Due to its location in a city park, the site would benefit from interpretive signage. *Phragmites* control should be a part of this project. Major Benefits: will benefit water quality by sequestering sediments and contaminants in runoff from parking lots; creates additional fish and wildlife breeding, nursery, and foraging habitat; will aid in the control of shoreline erosion; will provide educational opportunities; will provide greater connectivity of fringe wetland habitat along Bailey's Creek.

5) <u>Northwest Side Jordan Bridge</u> - This site is located on the north side of the northwest end of the Jordan Bridge in Chesapeake. The site is near two former wood treating facilities that caused creosote laden runoff to contaminate aquatic sediments in the area. The site is currently a shallow embayment that is fringed with approximately 0.095 acres of emergent wetland habitat. The restoration of this site will mostly consist of the creation of low marsh habitat containing *Spartina alterniflora* by placing clean coarse-grained fill in the embayment to the proper elevation and then planting the area. A two to three-foot oyster shell breakwater will be constructed on the eastern edge of the project to protect the wetland from erosion. This project will result in the creation of a total of 1.20 acres of wetland habitat at the site.

Recommendations: It will be important to include an erosion component in the monitoring and maintenance plan for this site. Major Benefits: clean and ultimately vegetated sediments will be placed over potentially contaminated sediments, reducing a contaminant pathway to ecological receptors; provides additional fish and wildlife breeding, nursery, and foraging habitat; provides additional water buffering capacity by filtering runoff from nearby industrial areas.

6) <u>Woodstock Neighborhood Park</u> - The site is located in Virginia Beach in a neighborhood park at the northern edge of a flooded barrow pit that is connected to the Eastern Branch of the Elizabeth River by a narrow cut. The site currently consists of mostly mowed upland with approximately 0.11 acres of emergent marsh at the edge of

the barrow pit. The restoration project will result in an increase to 1.6 acres of wetland habitat by the conversion of upland habitat to wetland by regrading and planting. The resulting marsh will have a gradual slope following a low marsh, high marsh, upland buffer progression.

Recommendations: As with Grandy Village, this is a good opportunity to restore a shoreline continuum going from emergent wetland, through wetland shrub, wetland/upland transition, and finally to forest. Also affords a good opportunity to establish warm season grasses in upland areas in addition to a forested fringe. Due to its location in a city park, the site would benefit from interpretive signage. Major Benefits: Creation of important wetland habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; provides educational opportunities for the local community; provides additional water buffering capacity.

7) <u>I-64 Crossing of Eastern Branch/Lancelot Drive</u> - This site is located on the south shore of the Eastern Branch just upstream of the I-64 bridge in Virginia Beach. A former dredge spoil disposal site, a large portion of this low marsh system is dominated by *Phragmites* and it is considered to be a source of *Phragmites* to surrounding marshes. The project will consist of regrading to eliminate *Phragmites* with limited disturbance to the remaining portions of the site, planting of low marsh and high marsh vegetation, and possibly the creation of tidal guts. The replacement of *Phragmites* dominated areas with salt marsh vegetation such as *Spartina alterniflora* and *Spartina patens* will increase the healthy salt marsh wetland acreage on the site from 1.3 to 5.4 acres.

Recommendations: It may be advisable to limit the amount of high marsh created at this site to reduce the potential for the reestablishment of *Phragmites*. Plant upland species between the marsh and the nearby residential neighborhood to provide a buffer. Since there is only a narrow strip of suitable land available for this, it may need to be in the form of warm season grasses or shrubs rather than trees, in order to prevent shading of the wetland plantings. Major Benefits: restoration and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; removal of a source of the invasive *Phragmites australis* from the watershed.

8) <u>Carolanne Farms Park</u> - This site is located on the north shore of the Eastern Branch in Virginia Beach. The site currently consists of a mowed upland field with 0.22 acres of wetland and is located in a neighborhood park. It is adjacent to a large emergent wetland area bordering the Eastern Branch. The plan for this site is to excavate and regrade a portion of the uplands to create a 1-acre bowl-shaped wetland depression that drains into the nearby existing marsh. Totaling 1.22 acres, the created wetland will be planted with *Spartina alterniflora* to create a high quality low marsh, contain a small fringe area of *Spartina patens*, and will surround a small area of open water habitat. Approximately 250 square feet of emergent marsh will be converted to tidal gut to provide tidal exchange to the restored marsh. The project will be surrounded by an upland fringe.

Recommendations: As with Grandy Village and Woodstock Neighborhood Park, this may also be a good opportunity to restore a shoreline continuum going from emergent wetland, through wetland shrub, wetland/upland transition, and finally to forest. Also affords a good opportunity to establish warm season grasses in upland areas in addition to a forested fringe. Care should be taken not to shade out wetland plantings with trees. Due to its location in a city park, the site would benefit from interpretive signage. Major Benefits: Creation of important wetland habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; provides educational opportunities for the local community; provides additional water buffering capacity.

Sediment Remediation

Based on the results of a reconnaissance study, five sites in the Elizabeth River were selected for potential sediment remediation. Selection criteria included: public use, likelihood of contamination, likelihood of project success, and risk of recontamination. These five sites are described below:

1. Scuffletown Creek - This creek is a tributary to the Southern Branch of the Elizabeth River and is located approximately two nautical miles upstream from the confluence of the Eastern and Southern Branches in the City of Chesapeake. A city park with a boat ramp is located at the mouth of the creek. Scuffletown Creek is located directly across the Elizabeth River from two former creosote plants, Wycoff Pipe and Creosote and Atlantic Wood Industries, and the U.S. Naval Shipyard. The latter two facilities are National Priority List (Superfund) sites. There is potential for contamination from these facilities and from a small ship repair facility located on the southern side of the creek, as well as stormwater runoff from upstream areas.

2. East of Campostella Bridge - This site is situated in a small cove just east of the Campostella Bridge on the Eastern Branch approximately 1.75 nautical miles from the confluence of the Eastern and Southern Branches. The site is adjacent to the Campostella Heights neighborhood in the City of Norfolk and has significant public visibility. Likely sources of contamination are ship repair facilities located directly across the river (Norfolk Shipbuilding and Drydock) and upriver, (Colonna Shipyard) and a construction fill site.

3. Scotts Creek - This creek is located in the City of Portsmouth and drains into the main stem of the Elizabeth River from the west bank. Neighboring communities are extremely active and have expressed an interest in restoring the creek. The most likely source of contamination is from three major stormwater outfalls that empty into the headwaters of the southern branch of Scotts Creek.

4. Paradise Creek - This creek is a tributary to the Southern Branch of the Elizabeth River approximately 2.5 nautical miles from the confluence of the Southern and Eastern Branches. It is located in the cities of Chesapeake and Portsmouth, adjacent to the Navy

Shipyard property. It receives drainage from both the Navy Shipyard and Atlantic Wood Superfund sites, likely sources of contamination.

5. Eppinger and Russel - This site is located on the east side of the Southern Branch in the City of Chesapeake, approximately 3.2 nautical miles from the confluence of the Southern and Eastern Branches. The general area has a long history of creosote wood treatment starting around the turn of the century. Over the years, creosote was released directly into the water via waste water and spills, such that pockets of pure creosote can still be found in bottom sediments. Concentrations of polycyclic aromatic hydrocarbons near this site are likely the highest in the river.

For the initial feasibility study, one of the five sediment remediation sites, Scuffletown Creek, was selected for an intensive sediment contamination investigation and the other sites were more broadly characterized. Early in the feasibility investigation, it was determined that Paradise Creek may be included as part of the remedial investigations at the U.S. Navy Shipyard and Atlantic Wood Industries Superfund sites. Because of the possibility that this site could be included in Superfund clean-up activities, the Sediment Subcommittee recommended that this site be dropped from further investigation in the feasibility study.

The Scuffletown Creek remediation project is expected to consist of dredging and disposal of contaminated sediments from hotspot areas. Disposal options are currently under evaluation. The approach used to evaluate the sediment contamination in Scuffletown Creek included chemical and biological analyses. Chemical characterization included analysis of 148 samples from the creek. A subsample of these were evaluated for sediment toxicity. Subsequent biological analyses included additional sediment toxicity tests, evaluation of benthic macroinvertebrate community structure and an investigation of the incidence of tumors in resident fish populations. The chemical data was useful in identifying hotspots and deriving clean-up scenarios (see below). The biological analyses provided information on the impacts of sediment contamination on living resources in Scuffletown Creek and a baseline for evaluating the environmental benefits of sediment remediation.

The preliminary chemical characterization information for the remaining sites, Scotts Creek, Campostella Bridge, and Eppinger and Russel site, was used to prioritize sites for future, more intensive, characterization and sediment remediation studies.

Derivation of Clean-up Values

There are several benchmarks that have been used to evaluate sediment quality, these include: empirical approaches such as Long and Morgan's (1990) Effects Range-Low and Effects Range-Median (ERL/ERM) and the threshold effects level/probable effects level (TEL/PEL) developed by Smith et al. (1996) that rely on correlations between sediment concentrations and biological effects; EPA's sediment quality guidelines that use a theoretical approach to estimate bioavailability of sediment contaminants; and more recently the development of consensus-based guidelines that integrate the empirical and theoretical approaches. At present, the number of chemicals for which EPA or consensus-based guidelines exist, is limited. Therefore, sediment contaminant data in Scuffletown Creek were evaluated by comparing ambient concentrations to either PEL or ERM values (whichever was lower). These benchmarks represent concentrations above which biological effects are frequently observed.

In order to summarize and integrate this information, Sediment Quotient Values (SQV) were calculated by dividing the concentration of a contaminant at each site by its sediment quality benchmark (i.e., ERM or PEL), summing these values and then taking the average. The SQV reflects both the magnitude and frequency by which benchmarks are exceeded and provide a way to integrate the chemical data on one scale. In addition, several researchers have shown a good correlation between SQVs and sediment toxicity or benthic community impairment (McGee *et al.*, 1999, Canfield *et al.* 1996, Fairey *et al.* 1999). Data from Baltimore Harbor presented in McGee *et al.* (1999) indicated that ERM SQVs of 0.4 and 0.8 delineated ranges where, at the low end, there was no observed sediment toxicity and, at the high end and above, there was always acute toxicity. Fairey *et al.* (1999) reported a similar relationship between SQVs and benthic community health in marine and estuarine sediments from California. Since these numbers seemed robust, the Sediment Subcommittee decided that 0.4, 0.6 and 0.8 would be the SQVs that would be contoured to identify hotspots in Scuffletown Creek, with the contours representing different clean-up scenarios.

Analysis of Environmental Benefits

Five indicators of sediment quality in Scuffletown Creek were used to evaluate the environmental benefits of sediment remediation. These included: the Benthic Index of Biotic Integrity (B-IBI) which is a multi-metric index indicative of benthic macroinvertebrate health; toxicity of surficial sediments which typically reflects newly deposited sediments and the suitability of sediments for benthic organisms; toxicity of subsurface sediments which often reflects historic contamination and is habitat for deep dwelling, long-lived benthic organisms; prevalence of tumors in resident fish populations that is an indicator of fish community health and concentrations of sediment contaminants.

The Sediment Subcommittee developed a functional numerical index in which the value recorded for each of these indicators was placed on a scale from 1 (poor) to 7 (excellent). For example, in characterizing the toxicity of surficial sediments, high toxicity (less than 50% survival) was given a score of 1; moderate toxicity (50-80% survival) a score of 3; low toxicity (over 80% survival) a score of 5 and no toxicity (approximately 100% survival) a score of 7. The highest possible score is 35 and the lowest 5. The Sediment Subcommittee used this scoring system to estimate current conditions at Scuffletown Creek and the expected future conditions under the various clean-up scenarios (Tables 5 through 8). Projected scores ranged from 14, for current conditions in Scuffletown Creek /future conditions without the project, to 24.5 for clean-up levels using the 0.4 SQV.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The James River estuary is Virginia's most highly industrialized river system. It is also important as the Chesapeake Bay's largest port, a major oyster production area, and for its commercial and recreational fisheries. Despite the highly industrialized nature of the Hampton Roads area, the lower James River estuary continues to provide valuable habitat for fish and wildlife resources.

Along with the Chickahominy, Nansemond, and Lafayette Rivers, the Elizabeth River is a major tributary of the James River estuary. The Elizabeth River basin has been extensively altered by development, including the construction of the 2500-acre Craney Island Disposal Area in the mid-1950s which effectively "extended" the length of the main stem of the river by two miles.

The mean tide range in the Elizabeth River is 2.5 feet, with a maximum of 3.1 feet at the Southern Branch headwaters in the city of Chesapeake. Hampton Roads is within the meso- to polyhaline section of the Chesapeake Bay, with salinities averaging between 15 and 28 parts per thousand, depending on the depth and amount of freshwater inflow (Richards and Morton 1983).

Finfish

A number of general studies of finfish in the lower James River estuary have been conducted, primarily in association with environmental assessments of Federal and private projects. A wide variety of resident and migratory finfish utilize or migrate through the Hampton Roads area.

Anadromous fish, species that live in saline water and spawn in freshwater rivers, pass through the Hampton Roads area to reach their spawning and nursery grounds in the upper James River estuary between the Chickahominy River and Richmond and beyond. These species include striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), hickory shad (*A. Mediocris*), blueback herring (*A. aestivalis*), alewife (*A. pseudoharengus*), gizzard shad (*Dorosoma cepedianum*), Atlantic herring (*Clupea harengus*) and white perch (*Morone americans*). No major, successful spawning of striped bass, American shad, or river herrings is known to occur in the Elizabeth River. However, it is believed that upriver migration associated with high freshwater flow during storm events does occur in spring.

Many species of finfish that spawn in the ocean or lower Chesapeake Bay utilize the lower James River estuary as a nursery area or as adults. Dominant species include:

spot (*Leiostomas xanthurus*)
Atlantic croaker (*Micropogon undulatus*)
menhaden (*Brevoortia tyrannus*)
weakfish (*Cynoscion nebulosus*)
summer flounder (*Paralichthys dentatue*)
bluefish (*Pomatomus saltatrix*)
American eel (*Anguilla rostrata*)
striped mullet (*Mugil cephalus*)
silver perch (*Bairdiella chrysura*)
black drum (*Pogonias cromis*)

southern lungfish (*Menticirrhus americanus*)

A number of resident estuarine finfish are found in the lower James River estuary. Dominant species include:

hogchoker (*Trinectes maculatus*)
bay anchovy (*Anchoa mitchilli*)
Atlantic silverside (*Menidia menidia*)
gobies (*Gobiosoma sp.*)
striped killifish (*Fundulus majalis*)
blennies (*Chasmodes bosquianus* and *Hypsoblennius hentzi*)
oyster toadfish (*Opsanus tau*)

A demersal (bottom) finfish survey of the lower James River estuary, including Hampton Roads and the Elizabeth River concluded that the principal uses of the area by finfish are 1) as nursery grounds for spot, American shad, striped bass and weakfish; 2) feeding grounds for adult spot, Atlantic croaker, weakfish, and summer flounder; and 3) spawning grounds for resident forage species such as bay anchovy and Atlantic silverside (Hedgepeth et al 1981).

Avifauna

Mid-Winter Waterfowl Survey data collected 1998-2000 in the lower James River estuary, including the Elizabeth River, included these waterfowl species, in order of relative abundance:

canvasback	(*Aythya valisineria*)
ruddy duck	(*Oxyura jamaicensis*)
Canada goose	(*Branta canadensis*)
bufflehead	(*Bucephala albeola*)
northern shoveler	(*Anas clypeata*)
mallard	(*Anas platyrhyncos*)
ring-neck duck	(*Aythya collaris*)
mergansers	(*Mergus spp.*), (*Lophodytes cucullatus*)
gadwall	(*Anas strepera*)
American widgeon	(*Anas americana*)
green-winged teal	(*Anas crecca*)
scoters	(*Melanitta spp.*)
American black duck	(*Anas rubripes*)
common goldeneye	(*Bucephala clangula*)
northern pintail	(*Anas acuta*)
redhead	(*Aythya americana*)
oldsquaw	(*Clangula hyemalis*)
mute swan	(*Cygnus olor*)

Other waterfowl species that can be expected to commonly winter on the waterway include lesser scaup (*Aythya marila*), greater scaup (*Aythya affinis*), and wood duck (*Aix sponsa*). Species occurring infrequently or in small numbers include tundra swan (*Cygnus columbianus*), snow goose (*Chen caerulescens*), and Atlantic brant (*Branta bernicla*). Species that typically breed within the project area include Canada geese, wood ducks, black ducks, and mallards.

Other birds expected to occur in association with Elizabeth River aquatic habitats include: great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), double-crested cormorants (*Phalacrocorax auritus*), American avocet (*Recurvirostra americana*), black-bellied plover (*Pluvialis squatarola*), lesser yellowlegs (*Tringa flavipes*), dunlin (*Calidris alpina*), semi-palmated sandpiper (*Calidris pusilla*), dowitcher (*Limnodromus spp.*), willet (*Catoptrophorus semipalmatus*), black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), ring-billed gull (*Larus delawarensis*), laughing gull (*Larus atricilla*), least tern (*Sterna antillarum*), royal tern (*Sterna maxima*), and caspian tern (*Sterna caspia*). Many of these species and other waterbirds are observed as transients, sometimes in high concentration, at and around Craney Island at the mouth of the Elizabeth. Raptors such as the Federally threatened bald eagle (*Haliaeetus leucocephalus*) and the osprey (*Pandion haliaetus*) nest and forage in the watershed. Many species use this area as a feeding and/or resting stop during migration.

Benthic Resources

Benthic invertebrates are the predominant food source for many estuarine fishes, including the young of many sport and commercial species, and many motile invertebrates, such as the blue crab. Studies have suggested that while the densities of the benthos of shallow sandy areas in the Chesapeake Bay are lower than that of deeper and offshore areas, the populations turn over rapidly and are exploited by predators (Virnstein, 1976).

In one study of the macrobenthos of Hampton Roads, the lower James River and the Elizabeth River, 175 taxa were collected. The dominant taxa were Polychaeta (54 forms), Gastropoda (23 forms), Amphipoda (22 forms) and Bivalvia (18 forms), with a higher species richness on sand substrates versus mud bottoms (Boesch 1971, 1972, 1973).

A year-long study of macroinvertebrates at 12 stations located along the major navigation channels in the lower Chesapeake Bay, Hampton Roads, Elizabeth River and James River identified a total of 227 taxa (Dauer 1984). Polychaetes comprised 45% of the taxa, bivalves 12%, amphipods 12%, and gastropods 11%. Species found to be dominant in the high silt-clay sediments of inner Hampton Roads, Elizabeth River, and James River included: *Leucon americanus*, *Streblospio benedicti*, *Nereis succina*, *Eteone heteropoda*, and *Leitoscoloplos fragilis*.

Wetlands

Though the project area is situated within a highly developed landscape, wetland systems do persist, particularly near the Elizabeth's headwaters and in portions of the watershed with relatively lower-density development. Wetland types found in the project area include palustrine forested, palustrine emergent, estuarine, lacustrine, and riverine. Extensive saltmarsh communities dominated by saltmarsh cordgrass (*Spartina alterniflora*) are present in the Elizabeth River basin. Wherever wetland systems exist in the project area, they are likely to be adjacent to lands characterized by human development.

Commercial Resources

Commercial fisheries on the lower James River estuary and Elizabeth River include oysters (*Crassostrea virginica*), blue crab (*Callinectes sapidus*), hard clam (*Mercenaria*), Atlantic croaker, American eel, striped bass, bluefish, and sea trout. In 1994 and 1995, the Virginia Marine Resources Commission reported that the main commercial fisheries on the Elizabeth River itself were blue crab, Atlantic croaker, and American eel.

Despite severely depleted bay-wide oyster abundance, the lower James River remains an important oyster harvest region. In 1992-93, the majority of Virginia's harvest came from these waters. In Hampton Roads, oyster abundance is limited by the predatory oyster drill (*Urosalpinx cinerea*), and the pathogens MSX (*Haplosporidium nelsoni*) and dermo (*Perkinsis marinus*).

Hard clams are also present in Hampton Roads, near the Elizabeth River mouth. Hard clams in this area are currently condemned for harvest and consumption due to fecal coliform contamination.

<u>Historic Changes in Aquatic Habitats of Lower James River Estuary</u>

The Elizabeth River basin has undergone significant shoreline and channel modifications for over 200 years as port facilities and surrounding cities have developed. Some filling of low areas in Hampton Roads began after arrival of colonists in the 1600s to 1700s, but large scale filling of wetlands, creeks, and shoreline areas started in the late 1800s, with many creek systems totally filled in for storm sewer systems or upland creation. There has been extensive filling along the Eastern and Southern Branches of the Elizabeth River for port and commercial facilities. The existing Craney Island Disposal Area filled in approximately 2500 acres of Hampton Roads.

Comparison of Coast Charts from 1909-1913 and 1983 indicates a net loss of at least 4600 acres, or 13 percent, of aquatic habitat in the lower James River/Hampton Roads/Elizabeth River. Nichols and Howard-Strobel (1986) indicate that the Elizabeth River system itself has had a 27 percent reduction in open water, wetlands and intertidal areas since the late 1800s. Priest and Hopkins (1997) estimate that as much as 50% of the tidal wetlands in the Elizabeth River Basin were lost between 1944 and 1977.

Significant deepening of the channels of the port started in the late 1800s. The Norfolk Harbor Reach and Elizabeth River channels have been deepened from an average natural depth of 20 feet to between 35 and 45 feet. These channels now comprise approximately 25 percent of the original river area and have resulted in a 50 percent increase in river volume. There may be a direct correlation between increasing channel depths and the frequency of maintenance dredging, as evidenced by sedimentation rates in the Elizabeth River that have increased by 1000 to 10,000 percent over natural rates (Nichols and Howard-Strobel 1986).

Other hydrodynamic changes are evident as well. Twenty-four percent of the tidal prism of the Elizabeth River has been lost as a result of filling, and tidal currents at the mouth of the river have been reduced by 17 percent (Nichols and Howard-Strobel 1986). These changes have likely contributed to low flushing rates in the Elizabeth and probable increases in salinity values.

Most filled or dredged areas within the port were once wetlands and shallow water habitats important as foraging and nursery areas for finfish, benthos, waterfowl and shorebirds. Dredging of deep channels and borrow areas and increased sedimentation by fine grained and contaminated sediments has created bottom areas with lower water quality and a less diverse assemblage of benthic species.

Threatened and Endangered Species

There are several active Federally threatened bald eagle (*Haliaeetus leucocephalus*) nests in the Elizabeth River watershed, however, no Federally threatened or endangered species are known to occur within the project impact zones.

Future Without the Project

The future condition without the wetland restoration project is the continuation of present degraded conditions. This will result in continued scarcity of healthy wetland habitat, reduced water quality, and low abundance and diversity of fish and wildlife species that depend on wetlands for their life requirements. Several of the sites, if not restored, will continue to serve as source areas for the spread of the invasive *Phragmites australis*, further degrading wetland habitats in the watershed.

The expected future condition without the sediment remediation project in Shuffletown Creek is the continuation of high levels of contaminants in sediments. Shuffletown Creek sediments will continue to serve as a source of contamination to the Elizabeth River, adding to the degradation of environmental quality in the watershed and detrimental acute and chronic effects to fish, wildlife, and their food species. Migration of contaminants originating in Scuffletown Creek throughout the Elizabeth River system and into the Chesapeake Bay will likely continue.

BIOLOGICAL EFFECTS OF THE PROJECT

Most of the biological effects of this project are positive. Impacts to water quality and upland, wetland, and shallow water fish and wildlife habitats are minimal compared to the benefits derived from the habitat restoration and sediment remediation measures expected to be employed in this project. The results of the HEP analysis and the wetland functional assessment suggest that the proposed restoration projects will make a substantive environmental improvement.

Temporary local effects to water quality are expected during all restoration and remediation activities. Sediments will be released to the water column during the dredging of contaminated bottom sediments at Scuffletown Creek, excavation activities at previously filled wetlands, and the placement of fill materials in shallow water areas to create the elevations necessary for intertidal wetland development. Efforts will be made to minimize the resuspension and transport of sediments during construction activities. The long-term benefits of the project to water quality in the Elizabeth River basin are expected to greatly exceed the temporary impacts. The wetland restoration projects will result in improved water quality by increasing the wetland acreage available to filter sediments and contaminants from stormwater runoff and non-point source discharges. The sediment remediation project at Scuffletown Creek will eliminate a source of contaminants this is currently contributing to the decline of water quality in the watershed and potentially causing acute and chronic toxicity to ecological receptors.

In many of the wetland restoration projects, habitat that is currently in the form of upland, degraded high marsh dominated by *Phragmites*, and shallow water habitat will be converted to low saltmarsh containing *Spartina* sp. Most of the upland sites and degraded high marsh sites, with the possible exception of Woodstock Neighborhood Park, are fill areas that historically supported emergent saltmarsh. The shallow water habitat that currently dominates the ODU drainage canal site receives large inputs of sediment laden stormwater runoff and is expected to be degraded due to the presence of runoff-derived contaminants. Creation of an emergent wetland at the mouth of the canal will provide water quality and habitat benefits that do not currently exist. Shallow water habitat that will be converted to wetland through filling at the Jordan Bridge is most likely contaminated with industrial contaminants from nearby wood treating facilities. The creation of wetlands at the Jordan Bridge will provide a net benefit to the local aquatic community by covering contaminated sediments and increasing the runoff filtering capacity of the embayment. Approximately 250 square feet of emergent marsh at Carolanne Farms will be excavated to establish a tidal connection between the restored marsh and nearby marshes. However, the project will result in a net increase of 1 acre of tidal emergent wetland.

CONCLUSIONS

The Elizabeth River Environmental Restoration Project will improve fish and wildlife habitat value within the Elizabeth River watershed by: 1) creating, improving, and enhancing wetland and upland areas that are breeding, nursery, and foraging habitats for fish and wildlife; and 2) reducing the threat to biological resources at certain locations where sediment contamination exists. We encourage the Corps to continue to work with the Service, other Federal, State, and local government agencies, and non-governmental organizations in the future to improve habitat and water quality conditions in the Elizabeth River watershed. Site-specific recommendations were presented previously in this document. We recommend that the following additional issues be evaluated during the next phase of the project: 1) develop a monitoring plan and protocol for adaptive management; 2) develop a *Phragmites* monitoring and control plan for the wetland restoration sites; 3) do not use excavated sediments from sites that are dominated by *Phragmites* as fill material at sites that require filling because they will most likely contain *Phragmites* rhizomes; and 4) consult with the Service concerning the planting of warm season grasses and trees in upland fringe areas adjacent to the wetland projects.

We appreciate the opportunity to consult with the Corps concerning this important restoration initiative. If you have any questions concerning these comments, please contact Dan Murphy at (410) 573-4521.

Sincerely,

John P. Wolflin
Supervisor
Chesapeake Bay Field Office

REFERENCES

Boesch, D.F. 1971. Distribution and Structure of Benthic Communities in the Hampton Roads Area, Virginia. Special Report in Applied Marine Science and Ocean Engineering No. 15, Virginia Institute of Marine Science. Gloucester Point, VA.

Boesch, D.F. 1972. Species diversity of marine macrobenthos in the Virginia area. Ches. Sci. 13:206-211.

Boesch, D.F. 1973. Classification and community structure of macrobenthos in the Hampton Roads area, Virginia. Marine Biology 21:226-244.

Canfield, T.J., F.J. Dwyer, J.F. Fairchild, P.S. Haverland, C.G. Ingersoll, N.I. Kemble, D.R. Mount, R.W. LaPoint, G.A. Burton, and M.C. Swift. 1996. Assessing contamination in Great Lakes sediments using benthic invertebrate communities and the Sediment Quality Triad. J. Great Lakes Res. 22:565-583.

Dauer, D.M. 1984. Macrobenthic Communities of the Lower Chesapeake Bay. Old Dominion University, Applied marine Research Laboratory. Norfolk, VA.

Fairey, R., J. Oakden, S. Lamerdin, B. Anderson, J. Hunt, and E. Long. 1999. Assessing Ecological Impacts on Benthic Community Structure from Sediments Contaminated with Multiple Pollutants. Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, November 1999, Philadelphia, PA.

Hedgepeth, M.Y., J.V. Merriner and F. Wojcik. 1981. Nekton Utilization of Aquatic Resources in the Elizabeth River and the Lower James River. In: A Study of Dredging Effects in Hampton Roads, Virginia. W.I. Priest (ed.). Special Report in Applied Marine Science and Ocean Engineering No. 247. Virginia Institute of Marine Science. Gloucester Point, VA.

Lewis, J.C. and R.L. Garrison. 1983. Habitat suitability index models: clapper rail. U.S. Fish and Wildlife Service, FWS/OBS-82/10.51. 15 pp.

Long, E.R. and L.G. Morgan. 1991. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. Office of Oceanography and Marine Assessment, Seattle, WA.

McGee, B.L., D.J. Fisher, L.T. Yonkos, G.P. Ziegler and S. Turley. 1999. Assessment of sediment contamination, acute toxicity and population viability of the estuarine amphipod *Leptocheirus plumulosus* in Baltimore Harbor. Environmental Toxicology and Chemistry. 18:2151-2160.

Nichols, M.N. and M.M. Howard-Strobel. 1986. Man's Physical Effects on the Elizabeth River.In: C.Y. Kuo and T.M. Younos (eds.). Effects of Upland and Shoreline Land Use on the Chesapeake Bay Research Conference, March 20-21, 1986.

Priest, W. I., III, and K.J. Hopkins. 1997. Historic losses of wetland habitat in the Elizabeth River. Virginia Institute of Marine Science for the Virginia Department of Environmental Quality, Virginia Coastal Resource Management Program and NOAA.

Richards, D.R. and M.R. Morton. 1983. Norfolk Harbor and Channels Deepening Study; Report 1, Physical Model Results; Chesapeake Bay Hydraulic Model Investigation. Tech. Rpt. HL-83-13. U.S. Army Corps of Engineers, Waterways Experiment Station. Vicksburg, MS.

Virnstein, R.W. 1976. The Effects of Predation by Epibenthic Crabs and Fishes on Benthic Infauna in Chesapeake Bay. Dissertation of the College of William and Mary. Williamsburg, VA.

U.S. Fish and Wildlife Service. 1980. Habitat Evaluation Procedures (HEP). Ecological Services Manual 102. Division of Ecological Services. Washington, D.C.

APPENDIX 2

PERTINENT CORRESPONDENCE

APPENDIX 2

PERTINENT CORRESPONDENCE

TABLE OF CONTENTS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Craig Seltzer
U.S. Army Corps of Engineers
Norfolk District
803 Front St
Norfolk, Virginia
23510-1096

May 22, 2001

Re: Elizabeth River Restoration Study

Dear Mr. Seltzer:

The Environmental Protection Agency (EPA) has reviewed the subject study and Environmental Assessment that outlines a series of environmental enhancements in portions of the Elizabeth River watershed. EPA has no objection to the proposals outlined in this study.

If you have any questions regarding this letter please feel free to contact me at 703-648-4292.

Sincerely,

Peter M Stokely
Virginia Field Office

Customer Service Hotline: 1-800-438-2474

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

April 30, 2001

Colonel Allan B Carroll
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Craig Seltzer

Re: Elizabeth River Environmental Restoration

Dear Colonel Carroll:

This constitutes the Final Report of the U.S. Fish and Wildlife Service (Service) on Norfolk District Corps of Engineer's (Corps) proposed environmental restoration project for the Elizabeth River in the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia. It is submitted in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 884, as amended; 16 U.S.C. 661 *et seq*) and Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). The purpose of this report is to present an evaluation of the project alternatives and to set forth the Service's official position on the recommended project as described in the Draft Feasability Study and Draft Environmental Assessment dated March 2001, the Formulation Analysis Notebook dated September 2000, the Project Study Plan dated July 1998, and other project-related documents. The Service previously submitted a Draft Fish and Wildlife Coordination Act Report dated November 2000

INTRODUCTION

The Elizabeth River watershed encompasses approximately 300 square miles within the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia. A tidal tributary to the Chesapeake Bay, the Elizabeth River has become heavily impacted by industrial and urban development over the years resulting in many environmental problems Three hundred years of industrial pollution have made the Elizabeth River one of the most polluted rivers in the United States. Over the years, stormwater runoff, point source discharges, and spills from commercial, industrial, and military sources have contaminated river sediments and lowered water quality Industrial and urban development and related filling activities have destroyed many wetland

(...SEE EA - APPENDIX 1 FOR COMPLETE U.S. FISH AND WILDLIFE SERVICE FINAL COORDINATION ACT REPORT)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

JUN - 7 2001

Colonel Allan B. Carroll
Distinct Engineer
U.S. Army Corps of Engineers
803 Front Street
Norfolk, Virginia 23510-1096

ATTN: Craig L. Seltzer

Ref.: Elizabeth River Restoration Environmental Assessment

Dear Colonel Carroll:

This is in reference to the **Draft Feasibility Study and Draft Environmental Assessment Main Report** for the Elizabeth River Basin, Virginia Environmental Restoration. We have reviewed the Environmental Assessment pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and the Fish and Wildlife Coordination Act, and have the following comments and recommendations.

We support efforts to clean up and restore the Elizabeth River. The removal of the contaminated sediments in Scuffletown Creek, a tributary of the Southern Branch of the Elizabeth River, along with the creation and restoration of 18 acres of wetland habitat, is a good beginning to restore the river.

Essential Fish Habitat

We reviewed the essential fish habitat (EFH) assessment section of the report, and we disagree with the findings of the assessment that proposed work will not adversely affect EFH. The proposed dredging of contaminated sediments could adversely impact juvenile fish, including anadromous fish species. This portion of the Elizabeth River is documented habitat for juvenile fish which serve as forage for federally managed species such as bluefish, which could be adversely affected by increased suspended contaminated sediment in the water column. Pursuant to Section 305(b)(4)(9A) of the MSFCMA, we offer the following Conservation Recommendation: that no dredging take place from February 15 through June 30, to reduce any potential adverse impacts from the proposal.

Section 305(b)(4)(B) of the MSFCMA requires the Army Corps of Engineers (ACOE) to provide a detailed written response to our EFH conservation recommendation, including a description of measures adopted by the ACOE for avoiding, mitigating, or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with NMFS' recommendations, the ACOE must explain its reasons for not following the recommendation, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
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Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5482

April 30, 2001

Mr. Mark T. Mansfield
Chief, Planning Branch
U.S. Army Corps of Engineers, Norfolk District
803 Front Street (Fort Norfolk)
Norfolk, Virginia 23510

RE: Draft Feasibility Study and Environmental Assessment:
Elizabeth River Basin Environmental Restoration
DEQ-01-050F

Dear Mr. Mansfield:

The Commonwealth of Virginia has completed its review of the Draft Feasibility Study and Environmental Assessment for the Environmental Restoration of the Elizabeth River. The Department of Environmental Quality is responsible for coordinating Virginia's review of federal environmental documents and responding to appropriate federal officials on behalf of the Commonwealth. The following agencies and locality joined in this review:

Department of Environmental Quality
Virginia Institute of Marine Science
Marine Resources Commission
City of Portsmouth.

In addition, the following agencies, planning district commission, and locality were invited to comment:

Department of Health
Department of Historic Resources
Department of Game and Inland Fisheries
Department of Conservation and Recreation
Chesapeake Bay Local Assistance Department
Hampton Roads Planning District Commission

An Agency of the Natural Resources Secretariat

City of Norfolk
City of Chesapeake
City of Virginia Beach.

Notwithstanding the degree of review participation indicated here, a number of agencies of the Commonwealth, along with the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach, have worked with the Corps of Engineers on this project for several years now, and it is fair to state that the Commonwealth strongly supports the Elizabeth River Restoration Project.

Project Description

The Corps proposes, with the assistance of its state and local partners, to accomplish a two-part project in the Elizabeth River watershed. One aspect of the project will address sediment conditions in Scuffletown Creek, a tributary to the Southern Branch of the Elizabeth River. This will be done by dredging of 60,270 cubic yards of contaminated sediment from that creek so that aquatic life, including bottom-dwelling species, may prosper once again (EA, page 2). The other aspect involves wetland restoration at eight different sites in the river system, which is intended to result in creation and/or restoration of approximately 18 acres of wetland habitat, 3 acres of riparian buffer habitat, and 1 acre of tidal creeks. The recommended plan involves a 65% federal, 35% non-federal cost share of the first cost ($11,281,853), and non-federal operation and maintenance estimated at $1,438 per year thereafter. (Feasibility Report Syllabus; EA, pages 1-2.)

Environmental Impacts and Mitigation

The Commonwealth would agree with a Finding of No Significant Impact (FONSI) for this project that follows, or substantially follows, the Draft FONSI in the document. Our comments on particular aspects of the project follow.

1. Water Quality and Wetlands. With regard to the remediation of contaminated sediments in Scuffletown Creek, the Draft EA discusses several alternative dredging methods and types of equipment contemplated for use (pages 25-29). We recommend that, for each area, the least environmentally damaging, practicable alternative be chosen. The different areas may require different dredging methods to be most effective in the restoration effort.

With respect to the wetland restoration and creation effort, we recommend preservation of the completed sites in perpetuity. We further recommend that deed restrictions be approved and recorded for as many of the eight sites as practicable.

We encourage the use of erosion and sediment control measures, adherence to stormwater management requirements, and careful construction practices to minimize temporary impacts to State waters during all construction activities.

In addition to testing the sediment to determine whether it has become re-contaminated (Study, page 104), we recommend that the Corps consider the Benthic IBI (index of biotic integrity) as a way to measure the success of the project.

As the EA indicates, the project will be subject to water resources permitting and federal consistency review (page 63). Additional detail on these and related matters appears in the discussion of "Regulatory and Coordination Needs," below.

2. Air Quality. The EA mentions that construction equipment will generate exhaust fumes when used, and states that both dredging and wetland restoration activities will result in some "volatilization of contaminants" (i.e., contaminants will evaporate or become airborne). The EA mentions canopy cover measures as a means to address this impact (page 51). We recommend that the Corps consider appropriate measures to control dust, in accordance with the Virginia Regulations for the Control and Abatement of Air Pollution 9 VAC 5-50-60 et seq.).

The Elizabeth River is in a maintenance area for ozone (O_3), and an emission control area for volatile organic compounds (VOCs) and oxides of nitrogen (NO_x). Accordingly, all reasonable precautions should be taken to limit the emissions of VOCs and NO_x. These precautions may include shutting down fuel-burning machinery when it is not in use.

3. Solid and Hazardous Waste Management. The Draft EA proposes storing some or all of the dredged sediments temporarily at the Craney Island Dredged Material Management Area (CIDMMA), with final disposal at the Higgerson Buchanan site on the Southern Branch of the Elizabeth River (page 43).

4. Endorsements. The City of Portsmouth believes that the combined document accurately reflects policy deliberations and technical analyses that took place over the course of the Feasibility Study. The City supports and endorses the "Views of the Non-Federal Sponsor" on page 151 of the Feasibility Study part of the document.

Similarly, the Virginia Institute of Marine Science, which has been thoroughly involved with the development of this project, agrees with the Draft EA and the Report.

Regulatory and Coordination Needs

1. Water Resources Permitting. As indicated above, the dredging and wetland restoration activities comprising this project will require water resources permitting within the Joint Federal-State Permit Process which involves the Corps, the DEQ, and the Marine Resources Commission. The Joint Federal-State Permit Application (JPA) should be filled out and submitted to the Marine Resources Commission (P.O. Box 756, Newport News, 23607), and all relevant permits must be obtained before the work begins.

The Marine Resources Commission administers two permit programs that may apply. For the dredging in Scuffletown Creek, a subaqueous bed encroachment permit may be required if that creek bed constitutes state-owned riverbed. The subaqueous bed encroachment permit may also apply to one or more of the wetland restoration sites, depending on its relation to state-owned bottomlands. For the wetland restoration and re-creation activities, tidal wetland permits may also be needed to allow encroachment on the intertidal zone between mean low water and mean high water lines. Additional information on this matter is available from the Commission (Traycie West, telephone (757) 247-2200).

The DEQ's Tidewater Regional Office has responsibility for the Virginia Water Protection Permit that is likely to apply to both the dredging and the wetland restoration aspects of this project. Additional information is available from that Office (Sheri Kattan, telephone (757) 518-2156 or Bert Parolari, telephone (757) 518-2166).

2. Air Quality Regulation. A permit is required for any open burning of land-clearing debris, pursuant to the Regulations for the Control and Abatement of Air Pollution, 9 VAC 5-40-5600 et seq.). If any open burning is contemplated, application must be made to the DEQ's Tidewater Regional Office. For information and requirements, please contact the Office (Jane Workman, telephone (757) 518-2112).

3. Federal Coastal Zone Management Act Consistency. The Virginia Coastal Resources Management Program (VCP) is comprised of a network of programs administered by several agencies. In order to be consistent with the VCP, the Corps of Engineers, as the applicant in this case, must obtain all the applicable permits and approvals listed under the Enforceable Programs of the VCP prior to commencing the project (see attached list). **Based on the consistency determination** (Draft EA, page 58) **that the Corps will obtain and comply with all approvals from agencies administering the applicable enforceable policies, as well as the foregoing comments and analysis, we concur with the finding that this proposed project is consistent with the VCP**. Other state requirements which may be applicable to this project are not included in this consistency concurrence.

If you have questions relative to federal consistency, please feel free to contact Charlie Ellis of this office (telephone (804) 698-4488).

<u>The Document</u>

We have a few suggestions to make regarding the Draft Feasibility Study that may improve its final version.

Page 29 (2nd paragraph). The Study says that states are developing action plans for Regions of Concern. In fact, action plans have been developed (or are being updated) and are being implemented.

Page 105. The term "functional score" appears for the first time in Table 18. We recommend that the reader be referred to pages 106-111 for the explanation of this concept.

Page 111. The Study indicates that the President of the United States was among the signatories of the Chesapeake Bay 2000 Agreement. In fact, the federal signatory was the EPA Administrator rather than the President. (The other signatories included the governors of Virginia, Maryland, and Pennsylvania, the Mayor of Washington, D.C., and the Chairman of the Chesapeake Bay Commission.)

Page 135. This page appears twice in a row.

Thank you for the opportunity to review this document. As previously stated, the Commonwealth of Virginia supports this effort to clean up the Elizabeth River. We look forward to reviewing the Final Study, EA, and FONSI.

Sincerely,

Michael P. Murphy

Michael P. Murphy, Director
Division of Environmental Enhancement

Enclosures
cc: Wendy Kedzierski, DEQ-VWPP
James P. Ponticello, DEQ-DAPC
Mark Richards, DEQ-CBP
Thomas A. Barnard, Jr., VIMS
Arthur Kapell, DEQ-OWP
James J. Gildea, City of Portsmouth
Traycie L. West, MRC
Sheryl A. Kattan, DEQ-TRO
Derral Jones, DCR
Catherine Harold, CBLAD
Raymond T. Fernald, DGIF
John M. Carlock, Hampton Roads PDC

WILLIAM&MARY
VIMS
Virginia Institute of Marine Science
School of Marine Science

CCRM
Center for
Coastal Resources Management

April 20, 2001

Mr. Charles H. Ellis, III
Environmental Programs Planner
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, 6th Floor
Richmond, VA 23219

RE: Elizabeth River Basin Environmental Restoration EA

Dear Charlie,

We have reviewed the above titled Environmental Assessment from a marine environmental perspective and found it to be a relatively thorough, well researched document. As you are aware, at the request of the Elizabeth River Project, VIMS has been involved from the earliest planning stages of this restoration program and thus our input has been incorporated regularly as the plan has evolved. Based on the information presented to this point, we concur with the approach described and have no further comments to make at the present time.

If I may answer any questions with regard to these comments, please do not hesitate to contact me.

Sincerely,

Thomas A. Barnard, Jr.
Marine Scientist

cc:
Mory Roberts, VIMS
Walter Priest, VIMS

DEQ VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

Chesapeake Bay Program
(804) 698-4392 Voice ♦ (804) 698-4319 Fax

Subject: Review of Draft Feasibility Study and Draft Environmental Assessment Main Report

To: Charlie Ellis,

From: Mark Richards

Date: April 20, 2001

Copies: File

Thanks for coordinating agency comments. Since I have served on the Steering Committee, and an associated technical committee, which have directed this process, I am very familiar with this project. Therefore, my comments are fairly minor.

Draft Feasibility Study

1) Page 29 (2nd paragraph) – "The Chesapeake Bay Program designated these three areas as 'Regions of Concern' (Figure 6), and ...are developing action plans to address toxic pollution problems in each location."

   Action plans have already been developed (or are in the process of being updated) in each ROC. Currently, these plans are being implemented. This clarification should be made in the text.

2) Page 105 (Table 18) – "Functional Score" has been included in the table. This is the first time this concept has surfaced in the document. It is suggested that the reader be referred to pages 106-111 for the explanation behind this concept.

3) Page 104 (paragraph under Table 17) – "These costs of $2,000 every five years include costs for testing the sediment to ensure the area has not become re-contaminated."

It is suggested that the Benthic IBI also be considered as a way to measure for the success of this project.

4) Page 111 (paragraph under Table 21) – "The Chesapeake Bay Agreement 2000, signed by the governors of three states (Maryland, Pennsylvania, and Virginia), the District of Columbia, and the President of the United States…"

   For purposes of clarification, Carol Browner, EPA's Administrator at that time, was the Federal Signatory for the C2K document, not the President of the United States.

5) Pages 135 (HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE) – The first three paragraphs under this heading have been replicated twice (i.e., there are two pages listed as 135).

Draft Environmental Assessment

No Comments.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr
Secretary of Natural Resources

5636 Southern Boulevard
Virginia Beach, VA 23462
Tel# (757) 518-2000
http://www deq.state.va us

Dennis H. Treacy
Director

Francis L Daniel
Tidewater Regional Director

May 24, 2001

Mr. William Sorrentino, Jr.
Chief, Technical Services Division
Norfolk District Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Re: Elizabeth River Restoration Feasibility Report

Dear Mr. Sorrentino:

This letter is in reference to the Elizabeth River Basin, Environmental Restoration feasibility investigation conducted by the Corps of Engineers, Norfolk District, in cooperation with five local cost-sharing sponsors: the Commonwealth of Virginia, and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach. During the last three and a half years, this office has had the opportunity to serve on the Steering Committee, a Sediment Subcommittee, and a Wetlands Subcommittee representing the Department of Environmental Quality (DEQ) as this investigation has proceeded. The committees have worked diligently to develop feasibility level concepts for restoring both wetlands and bottom sediment quality in the Elizabeth River.

A Draft Feasibility Report was prepared by the Corps and furnished to this office in March 2001. The recommended plan presented in the document includes sediment clean-up at Scuffletown Creek, a tributary to the Southern Branch of the river, and wetland restoration at eight different sites located throughout the river system.

Based upon our involvement in developing the recommended plan, and the information presented in the draft feasibility document, the proposed activities appear to be permittable under DEQ's authority to grant Virginia Water Protection permits issued pursuant to the State Water Control Law and Section 401 of the Clean Water Act. Final permitting of these projects will be completed upon review of the detailed plans and specifications which will be provided as part of a formal permit application during the Preconstruction, Engineering, and Design phase of this project.

The Department of Environmental Quality looks forward to continuing our involvement in this worthwhile and exemplary partnership.

Sincerely,

Bert W Parolari

Bert W. Parolari, Jr.
Water Resource Programs Manager

CC: Mr. Craig Seltzer

COMMONWEALTH of VIRGINIA

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
P.O. Box 756
Newport News, Virginia 23607-0756

William A. Pruitt
Commissioner

May 29, 2001

Mr. William Sorrentino, Jr.
Chief, Technical Services Division
Norfolk District Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Re: Elizabeth River Environmental Restoration Projects

Dear Mr. Sorrentino:

This letter is in reference to the Elizabeth River Basin, Environmental Restoration feasibility investigation that was conducted by the Norfolk District USACOE, in conjunction with five local cost-sharing sponsors: the Commonwealth of Virginia, and the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach. During the last three and a half years, this agency has participated on both the Executive Steering Committee and a Wetlands Subcommittee as the investigation proceeded. The committees worked diligently to develop feasibility level concepts for restoring both wetlands and bottom sediment quality in the Elizabeth River.

A Draft Feasibility Report was prepared by the Corps and furnished to this office in March 2001. The recommended plan presented in the document includes sediment clean up at Scuffletown Creek, a tributary to the Southern Branch of the Elizabeth River, as well as wetland restoration at eight different sites located throughout the river system.

Based upon the information presented in the draft feasibility document, and our involvement in developing the recommended plan, the proposed activities appear to be permittable under VMRC's authority to issue permits for reasonable uses of state-owned bottomlands pursuant to §28.2-1204 of the Code of Virginia.

Final permitting of these projects, however, will only be possible upon completion of our review of the detailed plans and specifications that are to be

An Agency of the Natural Resources Secretariat
Telephone (757) 247-2200 (757) 247-2292 V/TDD Information and Emergency Hotline 1-800-541-4646 V/TDD

provided as part of the formal permit application to be submitted during the Preconstruction, Engineering, and Design phase of this project.

Should you have any questions concerning the foregoing, please feel free to contact me at (757) 247-2250.

Sincerely,

Robert W. Grabb
Chief, Habitat Management Division

RWG/
HM
cc: William A. Pruitt
Craig L. Seltzer

THE CITY OF
PORTSMOUTH

RECEIVED

APR 20 2001

DEQ-Office of Environmental Impact Review

April 18, 2001

Mr. Charles H. Ellis III
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

Re: Environmental Review Request
Project Number: 01-050F
Project Title: Elizabeth River Basin Environmental Restoration
Project Sponsor: DOD/Army Corps of Engineers

Dear Mr. Ellis:

The City Manager has requested that I respond to your request for review and comment on the Draft Feasibility Study and Draft Environmental Assessment: Elizabeth River Basin Environmental Restoration.

The City of Portsmouth has been a participant in the deliberations that led to the completion of the dual feasibility study and draft environmental assessment.

We believe that this combined report accurately reflects both the technical/ scientific inputs from the many involved agencies and individuals as well as the policy deliberations and decisions which took place over the course of the study. Thus, we support and endorse the language found at page 151 of the report in the section entitled "Views of the Non-Federal Sponsor."

Thank you for this opportunity to comment.

Sincerely,

James J. Gildea

James J. Gildea, AICP
Director of Policy and Research

Office of the City Manager
P. O. Box 820 • Portsmouth, Virginia 23705-0820 • (757) 393-8641 • Fax (757) 393-5241

APPENDIX 3

COMMENTS AND RESPONSES

ENVIRONMENTAL ASSESSMENT

ELIZABETH RIVER ENVIRONMENTAL RESTORATION

EA APPENDIX 3

COMMENTS/RESPONSES

The following specific comments were raised during agency review of the draft feasibility report and environmental assessment. A response to each comment is also provided. The letter from the Virginia Department of Environmental Quality (DEQ), Division of Environmental Enhancement, dated April 30, 2001 provided consolidated comments from all the Virginia state agencies. Responses to these comments appear as a response to their letter. Copies of the letters providing agency comments can be found in EA-Appendix 2, Pertinent Correspondence.

1. LETTER FROM U.S. ENVIRONMENTAL PROTECTION AGENCY DATED 22 MAY, 2001

1.01 Comment: The Environmental Protection Agency (EPA) has reviewed the subject study and Environmental Assessment that outlines a series of environmental enhancements in portions of the Elizabeth River watershed. EPA has no objection to the proposals outlined in the study.

1.02 Response: No response required.

2. LETTER FROM THE U.S. DEPT. OF INTERIOR, FISH AND WILDLIFE SERVICE DATED 30 APRIL, 2001

Comments (Recommendations)

2.01 Comment: (Scuffletown Creek) **Recommendations**: The site is currently fringed by a thin forested area. This should be left in place to maintain habitat diversity at the site and to provide a buffer between the restored wetland and nearby degraded uplands. Major Benefits: re-establishes wetland habitat connectivity between two existing marshes; provides additional wildlife habitat and water buffering capacity.

2.02 Response: Current plan is to retain the thin forested area.

2.03 Comment: (Grandy Village) - **Recommendations**: The restoration of this site provides a significant opportunity to establish warm season grasslands in upland areas. A riparian forest should be created landward of the restored wetlands to provide a buffer from existing development. A grassland or shrub habitat (*Baccharis halmifolia, Iva frutescens*, and *Myrica* sp.) transition zone could be created between the forest and the wetland to increase habitat diversity and reduce the possibility of shading impacts. Soil amendments may be necessary to permit the establishment of vegetation in areas that are currently barren. It may be possible to use soils excavated from the site at other sites that require fill. The restored site would benefit from educational signage. Major Benefits: creation of important wetland and shallow water habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish (including anadromous fish and other forage species) and wildlife (including waterfowl, wading birds such as the blue heron, song birds, and neotropical migrants). Provides additional water buffering capacity; provides educational opportunities for the local community.

2.04 Response: Concur with suggestions and recommendations which will receive further consideration/development during the next project phase, advanced engineering and design.

2.05 Comment: (Old Dominion University (ODU) Drainage Canal) - **Recommendations**: Explore the opportunity of creating riparian habitat along the shoreline of the landfill by sloping fill material up against the existing embankment and planting trees. Good opportunity to use excavated material generated at other sites. This project provides an excellent opportunity for a student at ODU to perform a before and after study to document water quality benefits. Major Benefits: will benefit water quality by sequestering sediments and contaminants in runoff from a large surface area that is currently flowing unchecked into the Elizabeth River; creates additional fish and wildlife breeding, nursery, and foraging habitat; will aid in the control of shoreline erosion.

2.06 Response: Concur with suggestions and recommendations which will receive further consideration/development during the next project phase, advanced engineering and design.

2.07 Comment: (Portsmouth City Park) - **Recommendations**: Expand upland buffer plantings to include warm season grasses. Due to its location in a city park, the site would benefit from interpretive signage. *Phragmites* control should be a part of this project. Major Benefits: will benefit water quality by sequestering sediments and contaminants in runoff from parking lots; creates additional fish and wildlife breeding, nursery, and foraging habitat; will aid in the control of shoreline erosion; will provide educational opportunities; will provide greater connectivity of fringe wetland habitat along Bailey's Creek.

2.08 Response: Concur with all recommendations which will receive further consideration/development during the next project phase, advanced engineering and design.

2.09 Comment (Northwest Side Jordan Bridge) - **Recommendations**: It will be important to include an erosion component in the monitoring and maintenance plan for this site. Major Benefits: clean and ultimately vegetated sediments will be placed over potentially contaminated sediments, reducing a contaminant pathway to ecological receptors.

Provides additional fish and wildlife breeding, nursery, and foraging habitat; provides additional water buffering capacity by filtering runoff from nearby industrial areas.

2.10 Response: An erosion component is an integral part of the plan for this project. This will be further developed during the next project phase, advanced engineering and design.

2.11 Comment: (Woodstock Neighborhood Park) - **Recommendations**: As with Grandy Village, this is a good opportunity to restore a shoreline continuum going from emergent wetland, through wetland shrub, wetland/upland transition, and finally to forest. Also affords a good opportunity to establish warm season grasses in upland areas in addition to a forested fringe. Due to its location in a city park, the site would benefit from interpretive signage. Major Benefits: creation of important wetland habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; provides educational opportunities for the local community; provides additional water buffering capacity.

2.12 Response: Concur with suggestions and recommendations which will receive further consideration/development during the next project phase, advanced engineering and design.

2.13 Comment: (I-64 Crossing of Eastern Branch/Lancelot Drive) - **Recommendations:** It may be advisable to limit the amount of high marsh created at this site to reduce the potential for the reestablishment of *Phragmites*. Plant upland species between the marsh and the nearby residential neighborhood to provide a buffer. Since there is only a narrow strip of suitable land available for this, it may need to be in the form of warm season grasses or shrubs rather than trees, in order to prevent shading of the wetland plantings. Major Benefits: restoration and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; removal of a source of the invasive *Phragmites australis* from the watershed.

2.14 Response: Concur with suggestions and recommendations which will receive further consideration/development during the next project phase, advanced engineering and design.

2.15 Comment: (Carolanne Farms Park) - **Recommendations**: As with Grandy Village and Woodstock Neighborhood Park, this may also be a good opportunity to restore a shoreline continuum going from emergent wetland, through wetland shrub, wetland/upland transition, and finally to forest. Also affords a good opportunity to establish warm season grasses in upland areas in addition to a forested fringe. Care should be taken not to shade out wetland plantings with trees. Due to its location in a city park, the site would benefit from interpretive signage. Major Benefits: creation of important wetland habitat and enhancement of existing wetland and upland habitats that provide breeding, nursery, and foraging habitat for fish and wildlife; provides educational opportunities for the local community; provides additional water buffering capacity.

2.16 Response: Concur with suggestions and recommendations which will receive further consideration/development during the next project phase, advanced engineering and design.

2.17 Comment: **Conclusions** - The Elizabeth River Environmental Restoration Project will improve fish and wildlife habitat value within the Elizabeth River watershed by: 1) creating, improving, and enhancing wetland and upland areas that are breeding, nursery, and foraging habitats for fish and wildlife; and 2) reducing the threat to biological resources at certain locations where sediment contamination exists. The Service therefore concurs with Norfolk District's recommended plan of implementing sediment clean-up in Scuffletown Creek and wetland restoration at eight sites described earlier in this report. Because the environmental impacts of the project are overwhelmingly beneficial and more than offset the minor and temporary impacts from construction activities, the Service also concurs with Norfolk District's Finding of No Significant Impact.

We encourage the Corps to continue to work with the Service, other Federal, State, and local government agencies, and non-governmental organizations in the future to improve habitat and water quality conditions in the Elizabeth River watershed. Site-specific recommendations were presented previously in this document. We recommend that the following additional issues be evaluated during future phases of the project: 1) develop a monitoring plan and protocol for adaptive management; 2) develop a *Phragmites* monitoring and control plan for the wetland restoration sites; 3) do not use excavated sediments from sites that are dominated by *Phragmites* as fill material at sites that require filling because they will most likely contain *Phragmites* rhizomes; and 4) consult with the Service concerning the planting of warm season grasses and trees in upland fringe areas adjacent to the wetland projects.

2.18 Response: Monitoring and maintenance are addressed in the feasibility report. For the sediment site this includes some limited bulk chemical analysis but primarily entails the utilization of B-IBI field evaluations which will assess benthic community health in the restored area and in a reference site. Debris removal and *Phragmites* control are part of the long-term maintenance of the restored wetland sites. No adaptive management is envisioned for either the sediment or wetland sites. Excavated sediments from sites that are dominated by *Phragmites* will not be used as fill material at sites that require filling and the Corps will consult with the Service concerning the planting of warm season grasses and trees in upland fringe areas adjacent to the wetland projects during the next phase of project design.

3. LETTER FROM U.S. DEPARTMENT OF COMMERCE, NATIONAL MARINE FISHERIES SERVICE (NMFS), DATED 7 JUNE, 2001

3.01 Comment: We support efforts to clean up and restore the Elizabeth River. The removal of the contaminated sediments in Scuffletown Creek, a tributary of the Southern

Branch of the Elizabeth River, along with the creation and restoration of 18 acres of wetland habitat is good beginning to restore the river.

3.02 Response: Concur. No further response required.

3.03 Comment: We reviewed the essential fish habitat (EFH) assessment section of the report, and we disagree with the findings of the assessment that proposed work will not adversely affect EFH. The proposed dredging of contaminated sediments could adversely impact juvenile fish, including anadromous fish species. This portion of the Elizabeth River is documented habitat for juvenile fish which serve as forage for Federally managed species such as bluefish, which could be adversely affected by increased suspended contaminated sediment in the water column. Pursuant to Section 305(b)(4) 9A) of the MSFCMA, we offer the following Conservation Recommendation: that no dredging take place from February 15 through June 30, to reduce any potential adverse impacts from the proposal.

Section 305 (b)(4)(B) of the MSA requires the ACOE to provide a detailed written response to our EFH conservation recommendation, including a description of measures adopted by the ACOE for avoiding, mitigating or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with NMFS' recommendations, the ACOE must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate or offset such effects (50 CFR 600.920(j)).

Fish and Wildlife Coordination - This portion of the Elizabeth River is documented habitat for migrating adults, larva, and juvenile fish of the following anadromous fish: alewife, blueback herring, white perch, yellow perch, and American shad. The proposed dredging of contaminated sediments has the potential of re-suspending contaminates in the water column, and we recommend that no dredging take place from February 15 through June 30, to reduce the adverse impacts on anadromous fish. As you will note, these recommendations are the same as our EFH Conservation Recommendations.

3.04 Response: We do not agree with the NMFS conclusion that the proposed dredging would adversely affect Essential Fish Habitat (EFH). The proposed dredging will take place in a secluded creek off the main stem of the Southern Branch of the Elizabeth River and will be performed with equipment and in such a manner that suspended sediment in the water column will be minimized and retained within a relatively isolated area. Conversely, the Corps believes that EFH will be affected positively as a result of the sediment clean-up. The sole purpose of this restoration project is to improve ecosystem health by reducing bottom sediment toxicity, improving benthic community (fish food) abundance and diversity, and reducing the existing incident of fish cancers, lesions, and abnormalities. Scientific documentation of the existing condition and the benefits to fisheries related to the sediment clean-up are numerous and are presented throughout the feasibility study document and environmental assessment. Therefore, based upon our conclusion that EFH would not be adversely affected, the conservation recommendation that no dredging take place from February 15 through June 30 will not be enforced.

4. LETTER FROM THE VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ) DATED 30 APRIL, 2001

Environmental Impacts and Mitigation

4.01 Comment: *Water Quality and Wetlands.* With regard to the remediation of contaminated sediments in Scuffletown Creek, the Draft EA discusses several alternative dredging methods and types of equipment contemplated for use (pages 25-29). We recommend that, for each area, the least environmentally damaging, practicable alternative be chosen. The different areas may require different dredging methods to be most effective in the restoration effort.

4.02 Response: For each area, the least environmentally damaging, practicable alternative will be chosen. Our feasibility investigations have confirmed that the different areas may indeed require different dredging methods to be most effective in the restoration effort.

4.03 Comment: With respect to the wetland restoration and creation effort, we recommend preservation of the completed sites in perpetuity. We further recommend that deed restrictions be approved and recorded for as many of the eight sites as practicable.

4.04 Response: Once restored, the wetland sites will be preserved in such a way that no future activities would be detrimental to the project purpose of environmental restoration and the associated ecosystem functional benefits.

4.05 Comment: We encourage the use of erosion and sediment control measures, adherence to stormwater management requirements, and careful construction practices to minimize temporary impacts to State waters during all construction activities.

4.06 Response: All Best Management Practices (BMPs) will be employed during construction activities including the use of erosion and sediment control measures, adherence to stormwater management requirements, and careful construction practices to minimize temporary impacts to State waters.

4.07 Comment: In addition to testing the sediment to determine whether it has become recontaminated (Study, page 104), we recommend that the Corps consider the Benthic IBI (index of biotic integrity) as a way to measure the success of the project.

4.08 Response: The Benthic-IBI will be used as a follow-up tool to measure the success of the sediment clean-up.

4.09 Comment: As the EA indicates, the project will be subject to water resource permitting and federal consistency review (page 63). Additional detail on these and related matters appears in the discussion of "Regulatory and Coordination Needs," below.

4.10 Response: Prior to construction, all applicable permitting will be acquired.

4.11 Comment: *Air Quality.* The EA mentions that construction equipment will generate exhaust fumes when used, and states that both dredging and wetland restoration activities will result in some "volatilization of contaminants: (i.e., contaminants will evaporate or become airborne). The EA mentions canopy cover measures as a means to address this impact (page 51). We recommend that the Corps consider appropriate measures to control dust, in accordance with the Virginia Regulation for the Control and Abatement of Air Pollution 9 VAC 5-50-60 et seq.).

4.12 Response: This will be considered during the further development of the project in the next phase of the project (preconstruction, engineering, and design).

4.13 Comment: The Elizabeth River is in a maintenance area for ozone (O_3), and an emission control area for volatile organic compounds (VOCs) and oxides of nitrogen (NO_x). Accordingly, all reasonable precautions should be taken to limit the emissions of VOCs and NO_x. These precautions may include shutting down fuel-burning machinery when it is not in use.

4.14 Response: All reasonable precautions will be taken to limit the emissions of VOCs and NO_x. Further precautions will be considered during the future development in the next phase of the project (preconstruction, engineering, and design).

4.15 Comment: *Solid and Hazardous Waste Management.* The Draft EA proposes storing some or all of the dredged sediments temporarily at the Craney Island Dredge Material Management Area (CIDMMA), with final disposal at the Higgerson Buchanan site on the Southern Branch of the Elizabeth River (page 43).

4.16 Response: Dredged sediments may be temporarily stored at Craney Island Dredged Material Management Area, and/or Higgerson Buchanan. Final deposition may include some beneficial use and/or placement in a regulated landfill or the Higgerson Buchanan site.

4.17 Comment: *Endorsements.* The City of Portsmouth believes that the combined document accurately reflects policy deliberations and technical analyses that took place over the course of the Feasibility Study. The City supports and endorses the "Views of the Non-Federal Sponsor: on page 151 of the Feasibility Study part of the document.

Similarly, the Virginia Institute of Marine Science, which has been thoroughly involved with the development of this project, agrees with the Draft EA and the Report.

4.18 Response: No response required.

Regulatory and Coordination Needs

4.19 Comment: *Water Resources Permitting*. As indicated above, the dredging and wetland restoration activities comprising this project will require water resources permitting within the Joint Federal-State Process which involves the Corps, the DEQ, and the Marine Resources Commission. The Joint Federal-State Permit Application (JPA) should be filled out and submitted to the Marine Resources Commission (P.O. Box 756, Newport News, 23607), and all relevant permits must be obtained before the work begins.

The Marine Resources Commission administers two permit programs that may apply. For the dredging in Scuffletown Creek, a subaqueous bed encroachment permit may be required if that creek bed constitutes state-owned riverbed. The subaqueous bed encroachment permit may also apply to one or more of the wetland restoration sites, depending on its relation to state-owned bottomlands. For the wetland restoration and recreation activities, tidal wetland permits any also be needed to allow encroachment on the intertidal zone between mean low water and mean high water lines. Additional information on this matter is available from the Commission (Traycie West, telephone (757) 247-2200).

The DEQ's Tidewater Regional Office has responsibility for the Virginia Water Protection Permit that is likely to apply to both the dredging and the wetland restoration aspects of this project. Additional information is available from that Office (Sheri Kattan, telephone (757) 518-2156 or Bert Parolari, telephone (757) 518-2166).

4.20 Response: The Corps received a letter from DEQ dated 24 May, 2001 stating that "...Based upon our involvement in developing the recommended plan, and the information presented in the draft feasibility document, the proposed activities appear to be permittable under DEQ's authority to grant Virginia Water Protection permits issued pursuant to the State Water Control Act and Section 401 of the Clean Water Act. Final permitting of these projects will be completed upon review of the detailed plans and specifications which will be provided as part of a formal permit application during the Preconstruction, Engineering, and Design phase of this project."

All applicable state and local permits will be acquired prior to construction.

4.21 Comment: *Air Quality Regulation*. A permit is required for any open burning of land-clearing debris, pursuant to the Regulations for the Control and Abatement of Air Pollution, 9 VAC 5-40-5600 et seq. If any open burning is contemplated, application requirements please contact the Office (Jane Workman, telephone (757) 518-2112).

4.22 Response: If any open burning of land-clearing debris is part of the final project design, appropriate permits will be obtained pursuant to the Regulations for the Control and Abatement of Air Pollution, 9 VAC 5-40-5600 et seq.

4.23 Comment: *Federal Coastal Zone Management Act Consistency.* The Virginia Coastal Resources Management Program (VCP) is comprised of a network of programs administered by several agencies. In order to be consistent with the VCP, the Corps of Engineers, as the applicant in this case, must obtain all the applicable permits and approvals listed under the Enforceable Programs of the VCP prior to commencing the project (see attached list). Based on the consistency determination (Draft EA, page 58) that the Corps will obtain and comply with all approvals from agencies administering the applicable enforceable policies, as well as the foregoing comments and analysis, we concur with the finding that this proposed project is consistent with the VCP. Other state requirements, which may be applicable to this project, are not included in this consistency concurrence.

4.24 Response: Consistency with the Virginia Coastal Resources Management Program (VCP) is noted.

The Document

4.25 Comment: *Page 29 (2nd paragraph).* The Study says that states are developing action plans for Regions of Concern. In fact, action plans have been developed (or are being updated) and are being implemented.

4.26 Response: So noted and appropriate revisions made.

4.27 Comment: *Page 105.* The term "functional score" appears for the first time in Table 18. We recommend that the reader be referred to pages 106-111 for the explanation of this concept.

4.28 Response: So noted and appropriate revisions made.

4.29 Comment: *Page 111.* The Study indicates that the President of the United States was among the signatories of the Chesapeake Bay 2000 Agreement. In fact, the federal signatory was the EPA Administrator rather than the President. (The other signatories included the governors of Virginia, Maryland, and Pennsylvania, the Mayor of Washington, D.C., and the Chairman of the Chesapeake Bay Commission.)

4.30 Response: So noted and appropriate revisions made.

4.31 Comment: *Page 135.* This page appears twice in a row.

4.32 Response: So noted and appropriate revisions made.

XVIII. CONCLUSIONS

The Elizabeth River is a highly developed, industrialized, urban river system. This development has taken place over a period of more than 200 years. Over 50% of the wetlands have been lost in the river system just since World War II, and sediment contamination has led to the river being designated as one of three "Regions of Concern" in the Chesapeake Bay watershed. The loss of wetlands and sediment contamination has resulted in significant impacts to the biota of the Elizabeth River that has compromised its ecological value as an estuarine system.

The environmental degradation in the Elizabeth River which has resulted from the loss of wetlands and sediment contamination has been reviewed and evaluated with regard to the overall public interest and with consideration to engineering, economic, environmental, social, and cultural concerns. The conclusions drawn by this study are as follows:

a. The most appropriate plan for addressing the environmental problems and needs in the Elizabeth River Basin is environmental restoration which involves a combination of both sediment restoration at Scuffletown Creek, a tributary to the Southern Branch of the Elizabeth River, and wetland restoration at eight different sites throughout the river system.

b. Wetland restoration projects were formulated consistent with guidance contained in ER 1165-2-501, Civil Works Ecosystem Restoration Policy, and ER 1165-2-502 Ecosystem Restoration – Supporting Policy Information, and Section 206 of WRDA 1996, as amended. Sediment restoration projects were evaluated and found to be consistent with Section 312(b) of the Water Resources Development Act (WRDA) of 1990, Environmental Dredging, as amended by Section 205 of the Water Resources Development Act of 1996; and Section 224 of WDRA 1999; and as promulgated by Corps of Engineers Implementation Guidance dated 25 April 2001, and ER 1165-2-501.

c. The feasibility study document presents, through a plan formulation process, an NER plan that reasonably maximizes environmental restoration benefits compared to costs, consistent with the Federal objective. The recommended plan is shown to be cost effective and justified to achieve the desired level of environmental output.

d. The recommended plan is an acceptable means of addressing the environmental problems in the Elizabeth River, is in the Federal interest, and is economically, engineeringly, environmentally, culturally, and socially feasible.

f. The cities of Chesapeake, Norfolk, Portsmouth, Virginia Beach and the Commonwealth of Virginia which are the local cost-sharing sponsors, have indicated a willingness to participate in the construction of the recommended plan and assume ownership and OMRR&R responsibility upon completion of the project.

g. The NER Plan is the recommended plan and is the most appropriate plan for addressing the environmental problems and needs in the Elizabeth River Basin. The NER plan specifies environmental restoration which involves a combination of both sediment restoration at Scuffletown Creek and wetland restoration at eight different sites throughout the river system.

h. This interim final report is the first of several feasibility studies to be conducted over the next ten years. Follow-on feasibility studies will evaluate additional environmental restoration opportunities in the Elizabeth River Basin.

RECOMMENDATIONS

I have considered all significant aspects in the overall public interest which included environmental, social, and economic effects; and engineering feasibility. In view of these considerations, and the conclusions presented above, I recommend that the Elizabeth River environmental restoration be implemented in accordance with the National Ecosystem Restoration plan (NER plan), with such modifications as in the discretion of the Commander, HQUSACE, may be advisable, at an total estimated first cost of $13,190,000, with a total first cost to the United States estimated at $8,513,000.

The recommended NER plan involves a combination of both sediment restoration or clean-up at Scuffletown Creek, a tributary to the Southern Branch of the river, and wetland restoration at eight different sites throughout the river system.

The sediment restoration component of the NER plan should be accomplished under the authority of Section 312(b) of the Water Resources Development Act of 1990, as amended, and the wetland restoration component of the NER plan (which includes all eight wetland sites) should be accomplished under the authority of Section 206 of the Water Resources Development Act of 1996, as amended.

My recommendation is subject to the implementation policy guidance that was provided by the Office of the Assistant Secretary of the Army for Civil Works as outlined above. Also, this recommendation is subject to the non-Federal sponsor agreeing to comply with all applicable Federal laws and policies and other requirements including but not limited to:

a. Provide 35 percent of the separable project costs allocated to environmental restoration currently estimated at $1,490,000, 35 percent of the separable project costs allocated to sediment remediation currently estimated at $2,985,500, and 50 percent of the separate project costs allocated to recreation currently estimated at $202,000, as further specified below:

(1) Enter into an agreement which provides, prior to execution of a project cooperation agreement for the project, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(5) Provide, during construction, any additional costs as necessary to make its total contribution equal to 35 percent of the separable project costs allocated to environmental restoration, 35 percent of the separable project costs allocated to sediment remediation, and 50 percent of the separable project costs allocated to recreation.

b. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, at no cost to the Government, in accordance with applicable Federal and State laws and any specific directions prescribed by the Government.

c. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, currently estimated at $5150 annually, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

e. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

f. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

g. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

h. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

i. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

e. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

f. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

g. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

h. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

i. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

j. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project and otherwise perform its obligations in a manner that will not cause liability to arise under CERCLA.

k. Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project.

l. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

m. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

n. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

o. Not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

p. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms.

Federal participation in the recommended project is endorsed provided that, prior to construction, the non-Federal sponsor will execute the final Project Cooperation Agreement with the Federal Government.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and implementation funding. However, prior to transmittal to higher authority, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

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